MASSACHUSETTS MUTUAL LIFE INSURANCE COMPANY AND SUBSIDIARIES

CONSOLIDATED STATUTORY FINANCIAL STATEMENTS

As of and for the years ended December 31, 2019 and 2018

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MASSACHUSETTS MUTUAL LIFE INSURANCE COMPANY AND SUBSIDIARIES
CONSOLIDATED STATUTORY STATEMENTS OF FINANCIAL POSITION

	As of December 31, 2019	As of December 31, 2018
	(In Millions)	
Assets:		
Bonds	$ 106,023	$ 101,504
Preferred stocks	756	770
Common stocks – subsidiaries and affiliates	15,253	10,701
Common stocks – unaffiliated	1,189	503
Mortgage loans	28,408	24,548
Policy loans	14,973	14,119
Real estate	358	488
Partnerships and limited liability companies	9,172	8,767
Derivatives	12,597	9,076
Cash, cash equivalents and short-term investments	4,317	4,733
Other invested assets	2,353	1,153
Total invested assets	195,399	176,362
Investment income due and accrued	2,784	3,118
Federal income taxes	-	627
Net deferred income taxes	1,140	1,006
Other than invested assets	3,952	3,297
Total assets excluding separate accounts	203,275	184,410
Separate account assets	76,659	70,431
Total assets	$ 279,934	$ 254,841
Liabilities and Surplus:		
Policyholders' reserves	$ 134,564	$ 126,099
Liabilities for deposit-type contracts	15,399	14,475
Contract claims and other benefits	495	499
Policyholders' dividends	1,684	1,713
General expenses due or accrued	1,214	1,095
Federal income taxes	16	-
Asset valuation reserve	4,783	3,413
Repurchase agreements	3,834	5,001
Commercial paper	250	250
Collateral	3,399	3,018
Derivatives	10,201	5,296
Funds held under coinsurance	4,252	4,099
Other liabilities	4,291	3,842
Total liabilities excluding separate accounts	184,382	168,800
Separate account liabilities	76,659	70,431
Total liabilities	261,041	239,231
Surplus	18,893	15,610
Total liabilities and surplus	$ 279,934	$ 254,841

See accompanying notes to consolidated statutory financial statements

MASSACHUSETTS MUTUAL LIFE INSURANCE COMPANY AND SUBSIDIARIES
CONSOLIDATED STATUTORY STATEMENTS OF OPERATIONS

	Years Ended December 31, 2019	Years Ended December 31, 2018
	(In Millions)	
Revenue:		
Premium income	$ 23,099	$ 23,262
Net investment income	8,008	8,087
Fees and other income	1,496	1,135
Total revenue	32,603	32,484
Benefits, expenses and other deductions:		
Policyholders' benefits	25,258	23,515
Change in policyholders' reserves	2,168	4,277
Change in group annuity reserves assumed	(1,271)	(1,221)
General insurance expenses	2,514	2,494
Commissions	1,112	1,104
State taxes, licenses and fees	284	271
Other deductions	291	180
Total benefits and expenses	30,356	30,620
Net gain from operations before dividends and federal income taxes	2,247	1,864
Dividends to policyholders	1,671	1,695
Net gain from operations before federal income taxes	576	169
Federal income tax expense (benefit)	8	(159)
Net gain from operations	568	328
Net realized capital losses	(44)	(1,044)
Net income (loss)	$ 524	$ (716)

See accompanying notes to consolidated statutory financial statements

MASSACHUSETTS MUTUAL LIFE INSURANCE COMPANY AND SUBSIDIARIES
CONSOLIDATED STATUTORY STATEMENTS OF CHANGES IN SURPLUS

	Years Ended December 31, 2019	2018
	(In Millions)	
Surplus, beginning of year	$ 15,610	$ 15,705
Net increase/(decrease) due to:		
Net income (loss)	524	(716)
Change in net unrealized capital gains (losses), net of tax	3,328	1,726
Change in net unrealized foreign exchange capital gains (losses), net of tax	293	(618)
Change in other net deferred income taxes	(76)	280
Change in nonadmitted assets	779	(714)
Change in asset valuation reserve	(1,370)	(105)
Change in reserve valuation basis	-	(9)
Change in surplus notes	(33)	1
Change in minimum pension liability	(68)	128
Prior period adjustments	(70)	(46)
Other	(24)	(22)
Net increase (decrease)	3,283	(95)
Surplus, end of year	$ 18,893	$ 15,610

MASSACHUSETTS MUTUAL LIFE INSURANCE COMPANY AND SUBSIDIARIES
CONSOLIDATED STATUTORY STATEMENTS OF CASH FLOWS

	Years Ended December 31, 2019	Years Ended December 31, 2018
	($ In Millions)	
Cash from operations:		
Premium and other income collected	$ 23,406	$ 24,101
Net investment income	8,658	7,073
Benefit payments	(25,209)	(23,605)
Net transfers (to) from separate accounts	6,019	3,279
Net receipts from group annuity reserves assumed	1,271	1,221
Commissions and other expenses	(4,034)	(4,115)
Dividends paid to policyholders	(1,700)	(1,588)
Federal and foreign income taxes recovered	535	128
Net cash from operations	8,946	6,494
Cash from investments:		
Proceeds from investments sold, matured or repaid:		
Bonds	23,196	20,013
Preferred and common stocks – unaffiliated	862	992
Common stocks – affiliated	1	1,730
Mortgage loans	2,507	2,410
Real estate	192	276
Partnerships and limited liability companies	1,240	2,226
Derivatives	1,076	592
Other	(1,087)	(508)
Total investment proceeds	27,987	27,731
Cost of investments acquired:		
Bonds	(26,516)	(27,345)
Preferred and common stocks – unaffiliated	(1,445)	(316)
Common stocks – affiliated	(204)	(583)
Mortgage loans	(6,308)	(3,765)
Real estate	(120)	233
Partnerships and limited liability companies	(1,399)	(1,697)
Derivatives	(309)	(930)
Other	(96)	217
Total investments acquired	(36,397)	(34,186)
Net increase in policy loans	(854)	(550)
Net cash from investing activities	(9,264)	(7,005)
Cash from financing and miscellaneous sources:		
Net deposits on deposit-type contracts	855	92
Change in repurchase agreements	(1,168)	565
Change in collateral	624	21
Other cash (used) provided	(409)	627
Net cash from financing and miscellaneous sources	(98)	1,305
Net change in cash, cash equivalents and short-term investments	(416)	794
Cash, cash equivalents and short-term investments:		
Beginning of year	4,733	3,939
End of year	$ 4,317	$ 4,733

See accompanying notes to consolidated statutory financial statements

1. Nature of operations

Massachusetts Mutual Life Insurance Company (MassMutual), a mutual life insurance company domiciled in the Commonwealth of Massachusetts, and its domestic life insurance subsidiaries domiciled in the State of Connecticut (collectively, the Company), provide individual and group life insurance, disability insurance, individual and group annuities and guaranteed interest contracts (GIC) to individual and institutional customers in all 50 states of the United States of America (U.S.), the District of Columbia and Puerto Rico. Products and services are offered primarily through the Company's MassMutual Financial Advisors (MMFA), Digital Direct to Consumer and Business to Business (DTC&B2B), Institutional Solutions (IS) and Workplace Solutions (WS) distribution channels.

MMFA is a sales force that includes financial advisors that operate in the U.S. MMFA sells individual life, individual annuities and disability insurance. The Company's DTC&B2B distribution channel sells individual life and supplemental health insurance primarily through direct response television advertising, digital media, search engine optimization and search engine marketing. The Company's IS distribution channel sells group annuities, group life and GIC primarily through retirement advisory firms, actuarial consulting firms, investment banks, insurance benefit advisors and investment management companies. The Company's WS distribution channel sells group life insurance and annuity products as well as individual life insurance, critical illness and long term care (LTC) products distributed through investment advisors.

2. Summary of significant accounting policies

a. Basis of presentation

These consolidated statutory financial statements include MassMutual and its wholly-owned U.S. domiciled life insurance subsidiary, C.M. Life Insurance Company (C.M. Life), and C.M. Life's wholly-owned U.S. domiciled life insurance subsidiary, MML Bay State Life Insurance Company (MML Bay State). All intercompany transactions and balances for these consolidated entities have been eliminated. Other subsidiaries and affiliates are accounted for under the equity method in accordance with statutory accounting practices. Statutory financial statements filed with regulatory authorities are not presented on a consolidated basis.

The consolidated statutory financial statements have been prepared in conformity with the statutory accounting practices of the National Association of Insurance Commissioners (NAIC) and the accounting practices prescribed or permitted by the Commonwealth of Massachusetts Division of Insurance (the Division); and for the wholly-owned U.S. domiciled life insurance subsidiaries, the State of Connecticut Insurance Department (the Department).

Statutory accounting practices are different in some respects from financial statements prepared in accordance with U.S. generally accepted accounting principles (U.S. GAAP). The more significant differences between statutory accounting practices and U.S. GAAP are as follows:

Invested assets

- Bonds are generally carried at amortized cost, whereas U.S. GAAP reports bonds at fair value for bonds available for sale and trading or at amortized cost for bonds held to maturity
- Changes in the fair value of derivative financial instruments are recorded as changes in surplus, whereas U.S. GAAP generally reports these changes as revenue unless deemed an effective hedge
- Interest rate and credit default swaps associated with replicated asset transactions are carried at amortized cost, whereas U.S. GAAP would carry them at fair value
- Embedded derivatives are recorded as part of the underlying contract, whereas U.S. GAAP would identify and bifurcate certain embedded derivatives from the underlying contract or security and account for them separately at fair value
- Income recognition on partnerships and limited liability companies (LLCs), which are accounted for under the equity method, is limited to the amount of cash distribution, whereas U.S. GAAP is without limitation
- Certain majority-owned subsidiaries and variable interest entities are accounted for using the equity method, whereas U.S. GAAP would consolidate these entities

Policyholders' liabilities

- Statutory policy reserves are based upon prescribed methods, such as the Commissioners' Reserve Valuation Method, Commissioners' Annuity Reserve Valuation Method (CARVM) or net level premium method, and prescribed statutory mortality, morbidity and interest assumptions at the time of issuance, whereas U.S. GAAP policy reserves would generally be based upon the net level premium method or the estimated gross margin method with estimates, at time of issuance, of future mortality, morbidity, persistency and interest
- Liabilities for policyholders' reserves, unearned premium, and unpaid claims are presented net of reinsurance ceded, whereas U.S. GAAP would present the liabilities on a direct basis and report an asset for the amounts due from reinsurers for the amounts ceded
- Payments received for universal and variable life insurance products, certain variable and fixed deferred annuities and group annuity contracts are reported as premium income and corresponding change in reserves, whereas U.S. GAAP would treat these payments as deposits to policyholders' account balances

General insurance expenses and commissions

- Certain acquisition costs, such as commissions and other variable costs, directly related to successfully acquiring new business are charged to current operations as incurred, whereas U.S. GAAP generally would capitalize these expenses and amortize them based on profit emergence over the expected life of the policies or over the premium payment period

Net realized capital gains (losses)

- After-tax realized capital gains (losses) that result from changes in the overall level of interest rates for all types of fixed-income investments and interest-related hedging activities are deferred into the interest maintenance reserve (IMR) and amortized into revenue, whereas U.S. GAAP reports these gains and losses as revenue

Surplus

- Changes in the balances of deferred income taxes, which provide for book versus tax temporary differences, are subject to limitation and are recorded in surplus, whereas U.S. GAAP would generally include the change in deferred taxes in net income without limitation
- Assets are reported at admitted asset value and assets designated as nonadmitted are excluded through a charge against surplus, whereas U.S. GAAP recognizes all assets, net of any valuation allowances
- An asset valuation reserve (AVR) is reported as a contingency reserve to stabilize surplus against fluctuations in the statement value of real estate, partnerships and LLCs and certain common stocks as well as credit-related changes in the value of bonds, mortgage loans and certain derivatives, whereas U.S. GAAP does not record this reserve
- Changes to the mortgage loan valuation allowance are recognized in net unrealized capital gains (losses), net of tax, in the Consolidated Statutory Statements of Changes in Surplus, whereas U.S. GAAP reports these changes in net realized capital gains (losses)
- The overfunded status of pension and other postretirement plans, which is the excess of the fair value of the plan assets over the projected benefit obligation, is a nonadmitted asset for statutory accounting whereas U.S. GAAP recognizes the overfunded status as an asset
- Surplus notes are reported in surplus, whereas U.S. GAAP reports these notes as liabilities
- Consolidated Statutory Statements of Changes in Surplus includes net income, change in net unrealized capital gains (losses), change in net unrealized foreign exchange capital gains (losses), change in other net deferred income taxes, change in nonadmitted assets, change in AVR prior period adjustments and change in minimum pension liability, whereas U.S. GAAP presents net income as retained earnings and net unrealized capital gains (losses), change in net unrealized foreign exchange capital gains (losses), change in minimum pension liability as other comprehensive income
- The change in the fair value for unaffiliated common stock is recorded in surplus, whereas the change in the fair value for ownership interests in an entity not accounted for under the equity method or consolidated are recorded in revenue for U.S. GAAP

Other

- Assets and liabilities associated with certain group annuity and variable universal life contracts, which do not pass-through all investment experience to contract holders, are maintained in separate accounts and are presented on a single line in the statutory financial statements, whereas U.S. GAAP reports these contracts as general investments and liabilities of the Company

The preparation of financial statements requires management to make estimates and assumptions that impact the reported amounts of assets and liabilities, the disclosure of assets and liabilities as of the date of these consolidated statutory financial statements and the reported amounts of revenues and expenses during the reporting periods. The most significant estimates and assumptions include those used in determining the carrying values of investments including the amount of mortgage loan investment valuation reserves, other-than-temporary impairment(s) (OTTI), the value of the investment in MassMutual Holding LLC (MMHLLC), the liabilities for policyholders' reserves, the determination of admissible deferred tax assets (DTA), the liability for taxes and the liability for litigation or other contingencies. Future events including, but not limited to, changes in the level of mortality, morbidity, interest rates, persistency, asset valuations and defaults could cause results to differ from the estimates used in these consolidated statutory financial statements. Although some variability is inherent in these estimates, management believes the amounts presented are appropriate.

Certain prior year amounts within these financial statements have been reclassified to conform to the current year presentation.

b. Corrections of errors and reclassifications

For the years ended December 31, 2019 and 2018, corrections of prior years' errors were recorded in surplus, net of tax:

	Years Ended December 31, 2019 and 2018 Increase (Decrease) to:					
	Prior Years' Net Income		Current Year Surplus		Asset or Liability Balances	
	(In Millions)					
	2019	2018	2019	2018	2019	2018
Other than invested assets	$ (13)	(13)	$ 106	(13)	$ 106	13
Liabilities for deposit-type contracts	42	-	42	-	(42)	-
Other Liabilities	(7)	(2)	(7)	(2)	7	2
Contract claims and other benefits	(5)	-	(5)	-	5	-
Policyholders' reserves	(87)	(28)	(87)	(28)	87	28
Partnerships and limited liability companies	-	-	-	(61)	-	(61)
Deferred income taxes	-	-	-	(59)	-	(59)
Policyholders' dividends	-	(3)	-	(3)	-	3
Federal income tax receivable	-	-	-	1	-	(1)
Total	$ (70)	(46)	$ 49	(165)	$ 163	(75)

c. Bonds

Bonds are generally valued at amortized cost using the constant yield interest method with the exception of NAIC Category 6 bonds, which are in or near default, and certain residential mortgage-backed securities (RMBS) and commercial mortgage-backed securities (CMBS), which are rated by outside modelers, which are carried at the lower of amortized cost or fair value. NAIC ratings are applied to bonds and other investments. Categories 1 and 2 are considered investment grade, while Categories 3 through 6 are considered below investment grade. Bonds are recorded on a trade date basis, except for private placement bonds, which are recorded on the funding date.

For loan-backed and structured securities, such as asset-backed securities (ABS), mortgage-backed securities (MBS), including RMBS and CMBS, and structured securities, including collateralized debt obligations (CDOs), amortization or accretion is revalued quarterly based on the current estimated cash flows, using either the prospective or retrospective adjustment methodologies.

Fixed income securities with the highest ratings from a rating agency follow the retrospective method of accounting.

All other fixed income securities, such as floating rate bonds and interest only securities, including those that have been impaired, follow the prospective method of accounting.

The fair value of bonds is based on quoted market prices when available. If quoted market prices are not available, values provided by other third-party organizations are used. If values provided by other third-party organizations are unavailable, fair value is estimated using internal models by discounting expected future cash flows using observable current market rates applicable to yield, credit quality and maturity of the investment or using quoted market values for comparable investments. Internal inputs used in the determination of fair value include estimated prepayment speeds, default rates, discount rates and collateral values, among others. Structure characteristics and cash flow priority are also considered. Fair values resulting from internal models are those expected to be received in an orderly transaction between willing market participants.

Refer to *Note 2dd. "Net realized capital gains (losses) including other-than-temporary impairments and unrealized capital gains (losses)"* for information on the Company’s policy for determining OTTI.

d. Preferred stocks

Preferred stocks in good standing, those that are rated Categories 1 through 3 by the Securities Valuation Office (SVO) of the NAIC, are generally valued at amortized cost. Preferred stocks not in good standing, those that are rated Categories 4 through 6 by the SVO, are valued at the lower of amortized cost or fair value. Fair values are based on quoted market prices, when available. If quoted market prices are not available, values provided by third-party organizations are used. If values provided by third-party organizations are unavailable, fair value is estimated using internal models. These models use inputs not directly observable or correlated with observable market data. Typical inputs integrated into the Company’s internal discounted expected earnings models include, but are not limited to, earnings before interest, taxes, depreciation and amortization estimates. Fair values resulting from internal models are those expected to be received in an orderly transaction between willing market participants.

Refer to *Note 2dd. "Net realized capital gains (losses) including other-than-temporary impairments and unrealized capital gains (losses)"* for information on the Company’s policy for determining OTTI.

e. Common stocks - subsidiaries and affiliates

Common stocks of unconsolidated subsidiaries, primarily MassMutual Holding LLC (MMHLLC), is accounted for using the statutory equity method. The Company accounts for the value of MMHLLC at its underlying U.S. GAAP equity value less an adjustment of $733 million as of December 31, 2019 for a portion of its noncontrolling interests (NCI). Operating results, less dividends declared, for MMHLLC is reflected as net unrealized capital gains (losses) in the Statutory Statements of Changes in Surplus. Dividends declared from MMHLLC are recorded in net investment income when declared and are limited to MMHLLC’s U.S. GAAP retained earnings. The cost basis of common stocks – subsidiaries and affiliates is adjusted for impairments deemed to be other than temporary.

Refer to Note 5c. "Common stocks – subsidiaries and affiliates" for further information on the valuation of MMHLLC.

f. Common stocks - unaffiliated

Unaffiliated common stocks are carried at fair value, which is based on quoted market prices when available. If quoted market prices are not available, values provided by third-party organizations are used. If values from third parties are unavailable, fair values are determined by management using estimates based upon internal models. The Company's internal models include estimates based upon comparable company analysis, review of financial statements, broker quotes and last traded price. Fair values resulting from internal models are those expected to be received in an orderly transaction between willing market participants.

Refer to *Note 2dd. "Net realized capital gains (losses) including other-than-temporary impairments and unrealized capital gains (losses)"* for information on the Company's policy for determining OTTI.

g. Mortgage loans

Mortgage loans are valued at the unpaid principal balance of the loan, net of unamortized premium, discount, mortgage origination fees and valuation allowances. Interest income earned on impaired loans is accrued on the outstanding principal balance of the loan based on the loan's contractual coupon rate. Interest is not accrued for (a) impaired loans more than 60 days past due, (b) delinquent loans more than 90 days past due, or (c) loans that have interest that is not expected to be collected. The Company continually monitors mortgage loans where the accrual of interest has been discontinued, and will resume the accrual of interest on a mortgage loan when the facts and circumstances of the borrower and property indicate that the payments will continue to be received according to the terms of the original or modified mortgage loan agreement.

h. Policy loans

Policy loans are carried at the outstanding loan balance less amounts unsecured by the cash surrender value of the policy and amounts ceded to reinsurers.

i. Real estate

Investment real estate, which the Company has the intent to hold for the production of income, and real estate occupied by the Company are carried at depreciated cost, less encumbrances. Depreciation is calculated using the straight-line method over the estimated useful life of the real estate holding, not to exceed 40 years. Depreciation expense is included in net investment income.

Real estate held for sale is initially carried at the lower of depreciated cost or fair value less estimated selling costs and is no longer depreciated. Adjustments to carrying value, including for further declines in fair value, are recorded in a valuation reserve, which is included in net realized capital gains (losses).

Fair value is generally estimated using the present value of expected future cash flows discounted at a rate commensurate with the underlying risks, net of encumbrances. The Company also obtains external appraisals for a rotating selection of properties annually. If an external appraisal is not obtained, an internal appraisal is performed.

j. Partnerships and limited liability companies

Partnerships and limited liability companies, except for partnerships that generate and realize low income housing tax credits (LIHTCs), are accounted for using the equity method with the change in the equity value of the underlying investment recorded in surplus. Distributions received are recognized as net investment income to the extent the distribution does not exceed previously recorded accumulated undistributed earnings.

Investments in partnerships that generate LIHTCs are carried at amortized cost unless considered impaired. Under the amortized cost method, the excess of the carrying value of the investment over its estimated residual value is amortized into net investment income during the period in which tax benefits are recognized.

The equity method is suspended if the carrying value of the investment is reduced to zero due to losses from the investment. Once the equity method is suspended, losses are not recorded until the investment returns to profitability and the equity method is resumed. However, if the Company has guaranteed obligations of the investment or is otherwise committed to provide further financial support for the investment, losses will continue to be reported up to the amount of those guaranteed obligations or commitments.

k. Derivatives

Interest rate swaps and credit default swaps associated with replicated assets are valued at amortized cost and all other derivative types are carried at fair value, which is based primarily upon quotations obtained from counterparties and independent sources. These quotations are compared to internally derived prices and a price challenge is lodged with the counterparties and independent sources when a significant difference cannot be explained by appropriate adjustments to the internal model. When quoted market values are not reliable or available, the value is based on an internal valuation process using market observable inputs that other market participants would use. Changes in the fair value of these instruments other than interest rate swaps and credit default swaps associated with replicated assets are recorded as unrealized capital gains (losses) in surplus. Gains and losses realized on settlement, termination, closing or assignment of contracts are recorded in net realized capital gains (losses). Amounts receivable and payable are accrued as net investment income.

l. Cash, cash equivalents and short-term investments

Cash and cash equivalents, which are carried at amortized cost, consist of all highly liquid investments purchased with original maturities of three months or less.

Short-term investments, which are carried at amortized cost, consist of short-term bonds, money market mutual funds and all highly liquid investments purchased with maturities of greater than three months and less than or equal to 12 months.

The carrying value reported in the Consolidated Statutory Statements of Financial Position for cash, cash equivalents and short-term investment instruments approximates the fair value.

m. Investment income due and accrued

Accrued investment income consists primarily of interest and dividends. Interest is recognized on an accrual basis and dividends are recorded as earned on the ex-dividend date.

n. Federal income taxes

Total federal income taxes are based upon the Company’s best estimate of its current and DTAs or deferred tax liabilities. Current tax expense (benefit) is reported in the Consolidated Statutory Statements of Operations as federal income tax expense (benefit) if resulting from operations and within net realized capital gains (losses) if resulting from invested asset transactions. Changes in the balances of net deferred taxes, which provide for book-to-tax temporary differences, are subject to limitations and are reported within various lines within surplus. Accordingly, the reporting of book-to-tax temporary differences, such as reserves and policy acquisition costs, and of book-to-tax permanent differences, such as tax-exempt interest and tax credits, may result in effective tax rates in the Consolidated Statutory Statements of Operations that differ from the federal statutory tax rate.

o. Other than invested assets

Other than invested assets primarily includes the Company’s investment in corporate-owned life insurance, deferred and uncollected life insurance premium, receivable from subsidiaries and affiliates, reinsurance recoverable, fixed assets and other receivables.

p. Separate accounts

Separate accounts and sub-accounts are segregated funds administered and invested by the Company, the performance of which primarily benefits the policyholders/contract holders with an interest in the separate accounts. Group and individual variable annuity, variable life and other insurance policyholders/contract holders select from among the separate accounts and sub-accounts made available by the Company. The separate accounts and sub-accounts are offered as investment options under certain insurance contracts or policies. The returns produced by separate account assets increase or decrease separate account reserves. Separate account assets consist principally of marketable securities reported at fair value. Except for the Company’s seed money, supplemental accounts and certain guaranteed separate accounts issued in Minnesota, separate account assets can only be used to satisfy separate account liabilities and are not available to satisfy the general obligations of the Company. Separate account administrative and investment advisory fees are included in fees and other income.

Assets may be transferred from the general investments of the Company to seed the separate accounts. When assets are transferred, they are transferred at fair market value. Gains related to the transfer are deferred to the extent that the Company maintains a proportionate interest in the separate account. The deferred gain is recognized as the Company’s ownership decreases or when the underlying assets are sold. Losses associated with these transfers are recognized immediately.

Separate accounts reflect two categories of risk assumption: nonguaranteed separate accounts for which the policyholder/contract holder assumes the investment risk and guaranteed separate accounts for which the Company contractually guarantees a minimum return, a minimum account value, or both to the policyholder/contract holder. For certain guaranteed separate account products such as interest rate guaranteed products and indexed separate account products, reserve adequacy is performed on a contract-by-contract basis using, as applicable, prescribed interest rates, mortality rates and asset risk deductions. If the outcome from this adequacy analysis produces a deficiency relative to the current account value, a liability is recorded in policyholders' reserves or liabilities for deposit-type contracts in the Consolidated Statutory Statements of Financial Position with the corresponding change in the liability recorded as change in policyholders' reserves or policyholders' benefits in the Consolidated Statutory Statements of Operations.

Premium income, benefits and expenses of the separate accounts are included in the Consolidated Statutory Statements of Operations with the offset recorded in the change in policyholders’ reserves. Investment income, realized capital gains (losses) and unrealized capital gains (losses) on the assets of separate accounts, other than seed money, accrue to policyholders/contract holders and are not recorded in the Consolidated Statutory Statements of Operations.

q. Nonadmitted assets

Assets designated as nonadmitted by the NAIC primarily include pension plan assets, intangibles, certain electronic data processing equipment, advances and prepayments, certain investments in partnerships and LLCs for which qualifying audits are not performed, the amount of DTAs (subject to certain limitations) that will not be realized by the end of the third calendar year following the current year end, furniture and equipment, certain other receivables and uncollected premium greater than 90 days past due. Due and accrued income is nonadmitted on: (a) bonds delinquent more than 90 days or where collection of interest is improbable; (b) impaired bonds more than 60 days past due; (c) bonds in default; (d) mortgage loans in default where interest is 180 days past due; (e) rent in arrears for more than 90 days; and (f) policy loan interest due and accrued more than 90 days past due and included in the unpaid balance of the policy loan in excess of the cash surrender value of the underlying contract. Assets that are designated as nonadmitted are excluded from the Consolidated Statutory Statements of Financial Position through a change in nonadmitted assets on the Consolidated Statutory Statements of Changes in Surplus.

r. Reinsurance

The Company enters into reinsurance agreements with affiliated and unaffiliated insurers in the normal course of business to limit its insurance risk or to assume business.

Premium income, policyholders' benefits (including unpaid claims) and policyholders' reserves are reported net of reinsurance. Premium, benefits and reserves related to reinsured business are accounted for on bases consistent with those used in accounting for the original policies issued and the terms of the reinsurance contracts. The Company records a receivable for reinsured benefits paid, but not yet reimbursed by the reinsurer and reduces policyholders' reserves for the portion of insurance liabilities that are reinsured. Commissions and expense allowances on reinsurance ceded and modified coinsurance (Modco) reserve adjustments on reinsurance ceded are recorded as revenue. Commissions and expense allowances on Retirement Plan Group reinsurance assumed and Modco reserve adjustments on reinsurance assumed are recorded as an expense.

s. Policyholders' reserves

Policyholders' reserves are developed by actuarial methods and are determined based on statutory prescribed mortality/morbidity tables using specified interest rates and valuation methods that will provide for the present value of estimated future obligations in excess of estimated future premium on policies in force.

The Company waives deduction of deferred fractional premium at death and returns any portion of the final premium beyond the date of death. Reserves are computed using continuous functions to reflect these practices.

The Company charges a higher premium on certain contracts that cover substandard mortality risk. For these policies, the reserve calculations are based on a substandard mortality rate, which is a multiple of the standard mortality tables.

Certain variable universal life and universal life contracts include features such as guaranteed minimum death benefits (GMDB) or other guarantees that ensure continued death benefit coverage when the policy would otherwise lapse. The value of the guarantee is only available to the beneficiary in the form of a death benefit. The liability for variable and universal life GMDBs and other guarantees is included in policyholders' reserves and the related change in this liability is included in change in policyholders' reserves in the Consolidated Statutory Statements of Operations.

Certain individual variable annuity and fixed annuity products have a variety of additional guarantees such as GMDBs and variable annuity guaranteed living benefits (VAGLB). The primary types of VAGLBs include guaranteed minimum accumulation benefits (GMAB), guaranteed minimum income benefits (GMIB) including GMIB Basic and GMIB Plus and guaranteed minimum withdrawal benefits (GMWB). In general, these benefit guarantees require the contract owner or policyholder to adhere to a company-approved asset allocation strategy. The liabilities for individual variable annuity GMDBs and VAGLBs are included in policyholders' reserves in the Consolidated Statements of Financial Position and the related changes in these liabilities are included in change in policyholders' reserves in the Consolidated Statutory Statements of Operations.

Separate accounts include certain group annuity contracts used to fund retirement plans that offer a guarantee of a contract holder's principal, which can be withdrawn over a stated period of time. These contracts offer a stated rate of return backed by the Company. Contract payments are not contingent upon the life of the retirement plan participants.

Unpaid claims and claim expense reserves are related to disability and LTC claims. Unpaid disability claim liabilities are projected based on the average of the last three disability payments. LTC unpaid claim liabilities are projected using policy specific daily benefit amounts and aggregate utilization factors. Claim expense reserves are based on an analysis of the unit expenses related to the processing and examination of new and ongoing claims. Interest accrued on reserves is calculated by applying NAIC prescribed interest rates to the average reserves by year incurred.

Tabular interest, tabular reserves, reserves released, and tabular cost for all life and annuity contracts and supplementary contracts involving life contingencies are determined in accordance with NAIC Annual Statement instructions. For tabular interest, whole life and term products use a formula that applies a weighted average interest rate determined from a seriatim valuation file to the mean average reserves. Universal life, variable life, group life, annuity and supplemental contracts use a formula that applies a weighted average credited rate to the mean account value. For contracts without an account value (e.g., a Single Premium Immediate Annuity) a weighted average statutory valuation rate is applied to the mean statutory reserve or accepted actuarial methods using applicable interest rates are applied.

All policyholders' reserves and accruals are presented net of reinsurance. Management believes that these liabilities and accruals represent management's best estimate and will be sufficient, in conjunction with future revenues, to meet future anticipated obligations of policies and contracts in force.

t. Liabilities for deposit-type contracts

Liabilities for funding agreements, dividend accumulations, premium deposit funds, investment-type contracts such as supplementary contracts not involving life contingencies and certain structured settlement annuities are based on account value or accepted actuarial methods using applicable interest rates.

u. Participating contracts

Participating contracts are those that may be eligible to share in any dividends declared by the Company. Participating contracts issued by the Company represented 53% of the Company's policyholders' reserves and liabilities for deposit-type contracts as of December 31, 2019 and 54% as of December 31, 2018.

v. Policyholders' dividends

Dividends expected to be paid to policyholders in the following year are approved annually by MassMutual's Board of Directors and are recorded as an expense in the current year. The allocation of these dividends to policyholders reflects the relative contribution of each group of participating policies to surplus and considers, among other factors, investment returns, mortality and morbidity experience, expenses and taxes. The liability for policyholders' dividends includes the estimated amount of annual dividends and settlement dividends. A settlement dividend is an extra dividend payable at termination of a policy upon maturity, death or surrender.

w. Asset valuation reserve

The Company maintains an AVR that is a contingency reserve to stabilize surplus against fluctuations in the carrying value of common stocks, real estate, partnerships and limited liability companies as well as credit-related changes in the value of bonds, preferred stocks, mortgage loans, and certain derivatives. The AVR is reported as a liability within the Consolidated Statutory Statements of Financial Position and the change in AVR, net of tax, is reported within the Consolidated Statutory Statements of Changes in Surplus.

x. Repurchase agreements

Repurchase agreements are contracts under which the Company sells securities and simultaneously agrees to repurchase the same or substantially the same securities. These repurchase agreements are carried at cost and accounted for as collateralized borrowings with the proceeds from the sale of the securities recorded as a liability while the underlying securities continue to be recorded as an investment by the Company. Earnings on these investments are recorded as investment income and the difference between the proceeds and the amount at which the securities will be subsequently reacquired is amortized as interest expense. Repurchase agreements are used as a tool for overall portfolio management to help ensure the Company maintains adequate assets in order to provide yield, spread and duration to support liabilities and other corporate needs.

The Company provides collateral, as dictated by the repurchase agreements, to the counterparty in exchange for a loan. If the fair value of the securities sold becomes less than the loan, the counterparty may require additional collateral.

The carrying value reported in the Consolidated Statutory Statements of Financial Position for repurchase agreements approximates the fair value.

y. Commercial paper

The Company issues commercial paper (CP) in the form of unsecured notes. Interest on CP is calculated using a 360-day year based on the actual number of days elapsed. Due to the short-term nature of CP, the carrying value approximates fair value.

z. Interest maintenance reserve

The Company maintains an IMR that is used to stabilize net income against fluctuations in interest rates. After-tax realized capital gains (losses), which result from changes in interest rates for all types of fixed-income investments and interest-related derivatives, are deferred into the IMR and amortized into net investment income using the grouped amortization method. In the grouped amortization method, assets are grouped based on years of maturity. IMR is reduced by the amount ceded to reinsurers when entering into in force coinsurance ceding agreements. The IMR is included in other liabilities or, if negative, is recorded as a nonadmitted asset.

aa. Employee compensation plans

The Company has a long-term incentive compensation plan, under which certain employees of the Company and its subsidiaries may be issued phantom share-based compensation awards. These awards include Phantom Stock Appreciation Rights (PSARs) and Phantom Restricted Stock (PRS). These awards do not grant an equity or ownership interest in the Company.

PSARs provide the participant with the opportunity to share in the value created in the total enterprise. The PSAR value is the appreciation in the phantom stock price between the grant price and the share price at the time of exercise. Awards can only be settled in cash. PSARs typically cliff vest at the end of three years and expire five years after the date of grant. Vested PSARs may be exercised during quarterly two-week exercise periods prior to expiration. The compensation expense for an individual award is recognized over the service period.

PRS provide the participant with the opportunity to share in the value created in the total enterprise. Participants receive the full phantom share value (grant price plus/minus any change in share price) over the award period. Awards can only be settled in cash. PRS typically vests on a graded basis over five years, one third per year after years three, four and five. On each vesting date, a lump sum cash settlement is paid to the participant based on the number of shares vested multiplied by the most recent phantom stock price. Compensation expense is recognized on the accelerated attribution method. The accelerated attribution method recognizes compensation expense over the vesting period by which each separate payout year is treated as if it were, in substance, a separate award.

All awards granted under the Company’s plans are compensatory classified awards. Compensation costs are based on the most recent quarterly calculated intrinsic value of the PSARs (current share price less grant price per share not less than zero) and PRS (current share price per share), considering vesting provisions, net of forfeiture assumptions and are included in the Consolidated Statutory Statements of Financial Position as a liability in general expenses due or accrued. The compensation expense for an individual award is recognized over the service period. The cumulative compensation expense for all outstanding awards in any period is equal to the change in calculated liability period over period. The requisite service period for the awards is the vesting period.

At the time of death or disability, awards contain vesting conditions, whereby employees’ unvested awards immediately vest on an accelerated basis with a one-year exercise period for PSARs, full accelerated vesting and settlement for PRS awards granted 2016 and after. For PRS awards granted prior to 2016, awards vest on a pro-rata basis with immediate settlement.

At the time of retirement, for awards granted beginning in 2016, both PRS and PSAR vest according to the original grant terms. For awards granted prior to 2016, unvested awards immediately vest on an accelerated basis with a two-year exercise period for PSARs, and a pro-rata basis with immediate settlement for PRS.

The phantom share price is determined as the greater of the share price calculated using management basis core operating income or the share price calculated using management basis equity. This phantom share price is calculated and communicated to all participants quarterly and is used in calculating the liability of the Company based on intrinsic value.

bb. Other liabilities

Other liabilities primarily consist of the derivative interest expense liability, remittances and items not allocated, other miscellaneous liabilities, liabilities for employee benefits and accrued separate account transfers.

cc. Premium and related expense recognition

Life insurance premium revenue is generally recognized annually on the anniversary date of the policy. However, premium for flexible products, primarily universal life and variable universal life contracts, is recognized as revenue when received. Annuity premium is recognized as revenue when received. Disability income and LTC premium is recognized as revenue when due.

Premium revenue is adjusted by the related deferred premium adjustment. Deferred premium adjusts for the overstatement created in the calculation of reserves as the reserve computation assumes the entire year's net premium is collected annually at the beginning of the policy year and does not take into account installment or modal payments.

Commissions and other costs related to issuance of new policies and policy maintenance and settlement costs are charged to current operations when incurred. Surrender fee charges on certain life and annuity products are recorded as a reduction of benefits and expenses.

dd. Net realized capital gains (losses) including other-than-temporary impairments and unrealized capital gains (losses)

Net realized capital gains (losses), net of taxes, exclude gains (losses) deferred into the IMR and gains (losses) of the separate accounts. Realized capital gains (losses), including OTTI, are recognized in net income and are determined using the specific identification method.

Bonds - general

The Company employs a systematic methodology to evaluate OTTI by conducting a quarterly analysis of bonds. OTTI is evaluated in a manner consistent with market participant assumptions. The Company considers the following factors, where applicable depending on the type of securities, in the evaluation of whether a decline in value is other than temporary: (a) the likelihood that the Company will be able to collect all amounts due according to the contractual terms of the debt security; (b) the present value of the expected future cash flows of the security; (c) the characteristics, quality and value of the underlying collateral or issuer securing the position; (d) collateral structure; (e) the length of time and extent to which the fair value has been below amortized cost; (f) the financial condition and near-term prospects of the issuer; (g) adverse conditions related to the security or industry; (h) the rating of the security; (i) the Company's ability and intent to hold the investment for a period of time sufficient to allow for an anticipated recovery to amortized cost; and (j) other qualitative and quantitative factors in determining the existence of OTTI including, but not limited to, unrealized loss trend analysis and significant short-term changes in value.

In addition, if the Company has the intent to sell, or the inability, or lack of intent to retain the investment for a period sufficient to recover the amortized cost basis, an OTTI is recognized as a realized loss equal to the entire difference between the investment's amortized cost basis and its fair value at the balance sheet date.

When a bond is other-than-temporarily impaired, a new cost basis is established.

Bonds – corporate

For corporate securities, if it is determined that a decline in the fair value of a bond is other than temporary, OTTI is recognized as a realized loss equal to the difference between the investment's amortized cost basis and, generally, its fair value at the balance sheet date.

The Company analyzes investments whose fair value is below the cost for impairment. Generally, if the investment experiences significant credit or interest rate related deterioration, the cost of the investment is not recoverable, or the Company intends to sell the investment before anticipated recovery, an OTTI is recognized as realized investment loss.

Bonds - loan-backed and structured securities

For loan-backed and structured securities, if the present value of cash flows expected to be collected is less than the amortized cost basis of the security, an OTTI is recognized as a realized loss equal to the difference between the investment's amortized cost basis and the present value of cash flows expected to be collected. The expected cash flows are discounted at the security's effective interest rate. Internal inputs used in determining the amount of the OTTI on structured securities include collateral performance, prepayment speeds, default rates, and loss severity based on borrower and loan characteristics, as well as deal structure including subordination, over-collateralization and cash flow priority.

ABS and MBS are evaluated for OTTI using scenarios and assumptions based on the specifics of each security including collateral type, loan type, vintage and subordination level in the structure. Cash flow estimates are based on these assumptions and inputs obtained from external industry sources along with internal analysis and actual experience. Where applicable, assumptions include prepayment speeds, default rates and loss severity, weighted average maturity and changes in the underlying collateral values.

The Company has a review process for determining if CDOs are at risk for OTTI. For the senior, mezzanine and junior debt tranches, cash flows are modeled using multiple scenarios based on the current ratings and values of the underlying corporate credit risks and incorporating prepayment and default assumptions that vary according to collateral attributes of each CDO. The prepayment and default assumptions are varied within each model based upon rating (base case), historical expectations (default), rating change improvement (optimistic), rating change downgrade (pessimistic) and fair value (market). The default rates produced by these multiple scenarios are assigned an expectation weight according to current market and economic conditions and fed into a final scenario. OTTI is recorded if this final scenario results in the loss of any principal or interest payments due.

For the most subordinated junior CDO tranches, the present value of the projected cash flows in the final scenario is measured using an effective yield. If the current book value of the security is greater than the present value measured using an effective yield, an OTTI is taken in an amount sufficient to produce its effective yield. Certain CDOs cannot be modeled using all of the scenarios because of limitations on the data needed for all scenarios. The cash flows for these CDOs, including foreign currency denominated CDOs, are projected using a customized scenario management believes is reasonable for the applicable collateral pool.

For loan-backed and structured securities, any difference between the new amortized cost basis and any increased present value of future cash flows expected to be collected is accreted into net investment income over the expected remaining life of the bond.

Common and preferred stock

The cost basis of common and preferred stocks is adjusted for impairments deemed to be other than temporary. The Company considers the following factors in the evaluation of whether a decline in value is other than temporary: (a) the financial condition and near-term prospects of the issuer; (b) the Company's ability and intent to retain the investment for a period sufficient to allow for a near-term recovery in value; and (c) the period and degree to which the value has been below cost. The Company conducts a quarterly analysis of issuers whose common or preferred stock is not-in-good standing or valued below 80% of cost. The Company also considers other qualitative and quantitative factors in determining the existence of OTTI including, but not limited to, unrealized loss trend analysis and significant short-term changes in value.

Mortgage loans

The Company performs internal reviews at least annually to determine if individual mortgage loans are performing or nonperforming. The fair values of performing mortgage loans are estimated by discounting expected future cash flows using current interest rates for similar loans with similar credit risk. For nonperforming loans, the fair value is the estimated collateral value of the underlying real estate. If foreclosure is probable, the Company will obtain an external appraisal.

Mortgage loans are considered to be impaired when, based upon current available information and events, it is probable that the Company will be unable to collect all amounts of principal and interest due according to the contractual terms of the mortgage loan agreement. A valuation allowance is recorded on a loan-by-loan basis in net unrealized capital losses for the excess of the carrying value of the mortgage loan over the fair value of its underlying collateral. Such information or events could include property performance, capital budgets, future lease roll, a property inspection as well as payment trends. Collectability and estimated decreases in collateral values are also assessed on a loan-by-loan basis considering all events and conditions relevant to the loan. This evaluation is inherently subjective as it requires estimates that are susceptible to significant revisions as more information becomes available, as changes occur in the market or as negotiations with the borrowing entity evolve. If there is a change in the fair value of the underlying collateral or the estimated loss on the loan, the valuation allowance is adjusted accordingly. An OTTI occurs upon the realization of a credit loss, typically through foreclosure or after a decision is made to accept a discounted payoff, and is recognized in realized capital losses. The previously recorded valuation allowance is reversed from unrealized capital losses. When an OTTI is recorded, a new cost basis is established reflecting estimated value of the collateral.

Real estate

For real estate held for the production of income, depreciated cost is adjusted for impairments whenever events or changes in circumstances indicate the carrying amount of the asset may not be recoverable, with the impairment being included in realized capital losses. An impairment is recorded when the property’s estimated future net operating cash flows over ten years, undiscounted and without interest charges, is less than book value.

Adjustments to the carrying value of real estate held for sale are recorded in a valuation reserve as realized capital losses when the fair value less estimated selling costs is less than the carrying value.

Partnerships and limited liability companies

When it is probable that the Company will be unable to recover the outstanding carrying value of an investment based on undiscounted cash flows, or there is evidence indicating an inability of the investee to sustain earnings to justify the carrying value of the investment, OTTI is recognized in realized capital losses reflecting the excess of the carrying value over the estimated fair value of the investment. The estimated fair values of limited partnership interests are generally based on the Company’s share of the net asset value (NAV) as provided in the financial statements of the investees. In certain circumstances, management may adjust the NAV by a premium or discount when it has sufficient evidence to support applying such adjustments.

For determining impairments in partnerships that generate LIHTCs, the Company uses the present value of all future benefits, the majority of which are tax credits, discounted at a risk-free rate for future benefits of ten or more years and compares the results to its current book value. Impairments are recognized in realized capital losses reflecting the excess of the carrying value over the estimated fair value of the investment.

Unrealized capital gains (losses)

Unrealized capital gains (losses) include changes in the fair value of derivatives, excluding interest rate swaps and credit default index swaps associated with replicated assets; currency translation adjustments on foreign-denominated bonds; changes in the fair value of unaffiliated common stocks; changes in the fair value of bonds and preferred stocks that are carried at fair value; and changes in the inflation adjustments on U.S Treasury inflation-indexed securities. Changes in the Company’s equity investments in partnerships and LLCs, including the earnings as reported on the financial statements, earnings recorded as accumulated undistributed earnings, foreign exchange asset valuation and mark-to-market on operating assets, and certain subsidiaries and affiliates are also reported as changes in unrealized capital gains (losses). Unrealized capital gains (losses) are recorded as a change in net unrealized capital gains (losses), net of tax, within the Consolidated Statutory Statements of Changes in Surplus.

3. New accounting standards

Adoption of new accounting standards

In October 2018, the NAIC issued modifications to Statements of Statutory Accounting Principles (SSAP) No. 86, *Derivatives,* effective January 1, 2019. This guidance permits the use of the Overnight Index Swap (OIS) rate based on the Secured Overnight Financing Rate as a U.S. benchmark interest rate in addition to the U.S. Treasury rate, the LIBOR swap rate, the OIS rate based on the Fed Funds Effective Rate, and the SIFMA Municipal Swap Rate. The Company has not elected to apply hedge accounting, therefore adoption of this guidance did not have an impact on the Company's consolidated financial statements.

In November 2018, the NAIC issued SSAP No. 30R, *Unaffiliated Common Stock*, effective January 1, 2019. The modification included a clarification to the scope for unaffiliated common stock including Securities Exchange Commission registered investment companies, such as closed-end mutual funds and unit investments trusts. The modification also includes public stock warrants, while nonpublic stock warrants would be classified as derivative instruments. The modifications did not have a material effect on the Company's consolidated financial statements.

In November 2018, the NAIC adopted modifications to the liquidity risk disclosure requirements of SSAP No. 51R, *Life Contracts*, No. 52, *Deposit-Type Contracts,* and No. 61R, *Life, Deposit-Type and Accident and Health Reinsurance*, effective December 31, 2019. The modifications require the Company to provide additional liquidity risk information such as current surrender charges, amount of account value, cash value and reserves breakouts by withdrawal characteristics for certain general and separate account products and groups of products. Additionally, a reconciliation of amounts of total reserves disclosed to the applicable annual statement exhibits, and the corresponding financial statement line items is required. The modifications did not have a material effect on the Company's financial statements.

In April 2019, the NAIC adopted modifications to SSAP No. 16R, *Electronic Data Processing Equipment and Software,* effective January 1, 2020, the Company elected to early adopt effective April 1, 2019. This guidance aligns and clarifies the requirements for capitalizing implementation costs incurred in a hosting arrangement that is a service contract, with the requirement for capitalizing implementation costs incurred to develop or obtain internal-use software. Costs for implementation activities in the application development stage is capitalized, depending on the nature of the costs and would be nonadmitted, while costs incurred during preliminary project or post implementation stages are expensed as incurred. The amendments also require the entity to expense the capitalized implementation costs of a hosting arrangement that is a service contract over the lesser of the expected term of the hosting arrangement or five years. The Company adopted this guidance on a prospective basis and the adoption did not have a material impact to its financial statements.

In April 2019, the NAIC adopted modifications to SSAP Nos. 26R, *Bonds*, 43R, *Loan-Backed and Structured Securities*, and 86, *Derivatives*, reclassifying structured notes as specifically defined that expose the investor to the risk of principal loss as derivative instruments, effective December 31, 2019. These types of structured notes where there is an embedded derivative wrapped by a bond include underlying risks that are not linked to the issuer's credit. Structured notes are currently reported as long-term bonds valued at amortized cost; while as derivative instruments, structured notes would be carried at fair value. The adoption of these modifications did not have a material impact on the Company's financial statements.

Future adoption of new accounting standards

In June 2016, the NAIC adopted modifications to SSAP No. 51R, *Life Contracts*, to incorporate references to the Valuation Manual and to facilitate the implementation of principles-based reserving (PBR), which were effective on January 1, 2017. The adoption of PBR only applies to new life insurance policies issued after January 1, 2017, however the Company plans to adopt these revisions to SSAP No. 51R using the 3-year phased in approach by no later than January 1, 2020. The Company currently uses formulas and assumptions to determine reserves as prescribed by state laws and regulations. Under PBR, the Company will be required to hold the higher of (a) the reserve using prescribed factors and (b) the PBR reserve which considers a wide range of future economic conditions, computed using justified company experience factors, such as mortality, policyholder behavior and expenses. At the time of adoption, the modifications are not expected to have a material effect on the Company's total life reserves and surplus in the consolidated financial statements.

In November 2018, the NAIC issued SSAP No. 108, *Derivatives Hedging Variable Annuity Guarantees*, to provide special accounting guidance for limited derivatives hedging variable annuity guarantee benefits that are subject to fluctuations from interest rates, effective January 1, 2020 with early adoption permitted as of January 1, 2019. This modification applies to variable annuity contracts and other contracts involving certain guaranteed benefits that are valued under principles-based reserving. This modification permits an insurer to use macro-hedging by designating as the host contract, an entire book of business or subsection consisting of interest sensitive variable annuity guarantee benefits, in a fair value hedge. The Company is required to record at fair value the interest rate sensitive variable annuity guarantee (that is, the hedged item) and the related derivative hedging instrument. Changes in the fair value of the derivatives attributable to the hedged item are recorded in realized gains and losses to offset the changes in the fair value of the hedged item. The excess or deficiency of the change in fair value of the derivative compared to the change in the fair value of the hedged item should be recorded as an admitted deferred asset or deferred liability, and amortized through realized capital gains and losses over the remaining term of the interest rate sensitive variable annuity, not to exceed 10 years. The Company is also required to record a special surplus allocation of an amount equal to the deferred asset and deferred liability from unassigned surplus. Changes in the fair value of the derivative that is not attributable to the hedge risk should be recorded in unrealized gains and losses. The Company will be required to disclose information about the derivative and related hedged items. The Company is currently evaluating this guidance, but it's not expected to have a material impact on its financial statements.

In August 2019, the NAIC adopted modifications to SSAP No. 51R, *Life Contracts*, to incorporate references to the Valuation Manual and to facilitate the implementation of principles-based reserving (PBR). The adoption, effective January 1, 2020, only applies to certain annuity products and includes inforce policies issued after 1980. The Company currently uses formulas and assumptions to determine reserves as prescribed by state laws and regulations. Under PBR, the aggregate reserve for contracts falling within the scope of these requirements shall equal the stochastic reserve plus the additional standard projection amount less the projected IMR included in the starting assets. These requirements constitute the CARVM for all contracts encompassed by the scope. The modifications are not expected to have a material effect on the Company's total annuity reserves and surplus in the consolidated financial statements.

4. Fair value of financial instruments

The following presents a summary of the carrying values and fair values of the Company's financial instruments:

	December 31, 2019				
	Carrying Value	Fair Value	Level 1	Level 2	Level 3
	(In Millions)				
Financial assets:					
Bonds:					
U. S. government and agencies	$ 4,405	$ 4,988	$ -	$ 4,988	$ -
All other governments	1,590	1,763	-	1,694	69
States, territories and possessions	576	636	-	636	-
Political subdivisions	535	589	-	589	-
Special revenue	5,921	6,724	-	6,714	10
Industrial and miscellaneous	86,293	92,193	10	50,776	41,407
Parent, subsidiaries and affiliates	6,703	6,866	-	388	6,478
Preferred stocks	756	795	11	-	784
Common stocks - subsidiaries and affiliates	299	299	179	-	120
Common stocks - unaffiliated	1,189	1,189	917	-	272
Mortgage loans - commercial	24,993	25,957	-	-	25,957
Mortgage loans - residential	3,415	3,407	-	-	3,407
Derivatives:					
Interest rate swaps	11,037	12,449	-	12,449	-
Options	605	605	40	565	-
Currency swaps	915	915	-	915	-
Forward contracts	12	12	-	12	-
Credit default swaps	22	31	-	31	-
Financial futures	6	6	6	-	-
Cash, cash equivalents and short-term investments	4,317	4,317	259	4,058	-
Separate account assets	76,659	76,698	51,039	24,681	978
Financial liabilities:					
Guaranteed interest contracts	9,815	9,909	-	-	9,909
Group annuity contracts and other deposits	17,963	18,600	-	-	18,600
Individual annuity contracts	11,332	13,962	-	-	13,962
Supplementary contracts	1,281	1,283	-	-	1,283
Repurchase agreements	3,834	3,834	-	3,834	-
Commercial paper	250	250	-	250	-
Derivatives:					
Interest rate swaps	9,684	10,532	-	10,532	-
Options	10	10	2	8	-
Currency swaps	216	216	-	216	-
Forward contracts	162	162	-	162	-
Financial futures	129	129	129	-	-

Common stocks - subsidiaries and affiliates do not include unconsolidated subsidiaries, which had statutory carrying values of $14,954 million.

	December 31, 2018				
	Carrying Value	Fair Value	Level 1	Level 2	Level 3
	(In Millions)				
Financial assets:					
Bonds:					
U. S. government and agencies	$ 6,167	$ 6,507	$ -	$ 6,507	$ -
All other governments	1,488	1,483	-	1,416	67
States, territories and possessions	643	678	-	678	-
Political subdivisions	565	590	-	590	-
Special revenue	6,045	6,549	-	6,540	9
Industrial and miscellaneous	78,818	78,244	10	44,627	33,607
Parent, subsidiaries and affiliates	7,778	7,827	-	1,202	6,625
Preferred stocks	770	759	29	-	730
Common stocks - subsidiaries and affiliates	409	409	244	-	165
Common stocks - unaffiliated	503	503	195	-	308
Mortgage loans - commercial	23,169	23,623	-	-	23,623
Mortgage loans - residential	1,379	1,316	-	-	1,316
Derivatives:					
Interest rate swaps	6,879	7,108	-	7,108	-
Options	925	925	-	925	-
Currency swaps	879	879	-	879	-
Interest rate caps and floors	18	18	-	18	-
Forward contracts	109	116	-	116	-
Credit default swaps	18	6	-	6	-
Financial futures	248	248	-	248	-
Cash, cash equivalents and short-term investments	4,733	4,733	244	4,489	-
Separate account assets	70,431	70,419	43,868	25,988	563
Financial liabilities:					
Guaranteed interest contracts	8,825	8,729	-	-	8,729
Group annuity contracts and other deposits	17,863	17,951	-	-	17,951
Individual annuity contracts	11,129	12,240	-	-	12,240
Supplementary contracts	1,284	1,286	-	-	1,286
Repurchase agreements	5,001	5,001	-	5,001	-
Commercial paper	250	250	-	250	-
Derivatives:					
Interest rate swaps	5,022	5,486	-	5,486	-
Options	5	5	-	5	-
Currency swaps	239	239	-	239	-
Forward contracts	13	29	-	29	-
Credit default swaps	2	2	-	2	-
Financial futures	15	15	-	15	-

Common stocks - subsidiaries and affiliates do not include unconsolidated subsidiaries, which had statutory carrying values of $10,292 million.

Fair value is defined as the price that would be received from selling an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. The authoritative guidance for fair value establishes a measurement framework that includes a hierarchy used to classify the inputs used in measuring fair value. The hierarchy prioritizes the inputs to valuation techniques into three levels. Each level reflects a unique description of the inputs that are significant to the fair value measurements. The levels of the fair value hierarchy are as follows:

Level 1 – Observable inputs in the form of quoted prices for identical instruments in active markets.

Level 2 – Observable inputs other than Level 1 prices, such as quoted prices for similar assets or liabilities, quoted prices in markets that are not active or other inputs that are observable or can be derived from observable market data for substantially the full term of the assets or liabilities.

Level 3 – One or more unobservable inputs that are supported by little or no market activity and are significant to the fair value of the assets or liabilities. Level 3 assets and liabilities include financial instruments whose value is determined using internal models, as well as instruments for which the determination of fair value requires significant management judgment or estimation.

When available, the Company generally uses unadjusted quoted market prices from independent sources to determine the fair value of investments and classifies such items within Level 1 of the fair value hierarchy. If quoted prices are not available, prices are derived from observable market data for similar assets in an active market or obtained directly from brokers for identical assets traded in inactive markets. Investments that are priced using these inputs are classified within Level 2 of the fair value hierarchy. When some of the necessary observable inputs are unavailable, fair value is based upon internally developed models. These models use inputs not directly observable or correlated with observable market data. Typical inputs, which are integrated in the Company's internal discounted cash flow models and discounted earnings models include, but are not limited to, issuer spreads derived from internal credit ratings and benchmark yields such as London Inter-Bank Offered Rate (LIBOR), cash flow estimates and earnings before interest, taxes, depreciation and amortization estimates. Investments that are priced with such unobservable inputs are classified within Level 3 of the fair value hierarchy.

The Company reviews the fair value hierarchy classifications at each reporting period. Overall, reclassifications between levels occur when there are changes in the observability of inputs and market activity used in the valuation of a financial asset or liability. Such reclassifications are reported as transfers between levels at the beginning fair value for the reporting period in which the changes occur. Given the types of assets classified as Level 1 (primarily equity securities including mutual fund investments), transfers between Level 1 and Level 2 measurement categories are expected to be infrequent. Transfers into and out of Level 3 are summarized in the schedule of changes in Level 3 assets and liabilities.

The fair value of group annuity contracts and other deposits is determined by multiplying the book value of the contract by an average market value adjustment factor. The market value adjustment factor is directly related to the difference between the book value of client liabilities and the present value of installment payments discounted at current market value yields. The market value yield is measured by the Barclay's Aggregate Bond Index, subject to certain adjustments, and the installment period is equivalent to the duration of the Company's invested asset portfolio.

The fair value of individual annuity and supplementary contracts is determined using one of several methods based on the specific contract type. For short-term contracts, generally less than 30 days, the fair value is assumed to be the book value. For contracts with longer durations, guaranteed interest contracts and investment-type contracts, the fair value is determined by calculating the present value of future cash flows discounted at current market interest rates, the risk-free rate or a current pricing yield curve based on pricing assumptions using assets of a comparable corporate bond quality. Annuities receiving dividends are accumulated at the average minimum guaranteed rate and discounted at the risk-free rate. All others are valued using cash flow projections from the Company's asset/liability management analysis.

The following presents the Company's fair value hierarchy for assets and liabilities that are carried at fair value:

	December 31, 2019			
	Level 1	Level 2	Level 3	Total
	(In Millions)			
Financial assets:				
Bonds:				
Industrial and miscellaneous	$ 10	$ 148	$ 120	$ 278
Preferred stocks	-	-	13	13
Common stocks - subsidiaries and affiliates	179	-	120	299
Common stocks - unaffiliated	917	-	272	1,189
Derivatives:				
Interest rate swaps	-	11,037	-	11,037
Options	40	565	-	605
Currency swaps	-	915	-	915
Forward contracts	-	12	-	12
Financial futures	6	-	-	6
Separate account assets	51,039	23,498	967	75,504
Total financial assets carried at fair value	$ 52,191	$ 36,175	$ 1,492	$ 89,858
Financial liabilities:				
Derivatives:				
Interest rate swaps	$ -	$ 9,685	$ -	$ 9,685
Options	2	7	-	9
Currency swaps	-	216	-	216
Forward contracts	-	162	-	162
Financial futures	129	-	-	129
Total financial liabilities carried at fair value	$ 131	$ 10,070	$ -	$ 10,201

The Company does not have any financial instruments that were carried at NAV as a practical expedient.

The following presents the Company's fair value hierarchy for assets and liabilities that are carried at fair value:

	December 31, 2018			
	Level 1	Level 2	Level 3	Total
	(In Millions)			
Financial assets:				
Bonds:				
Special revenue	$ -	$ 1	$ -	$ 1
Industrial and miscellaneous	10	30	68	108
Parent, subsidiaries and affiliates	-	84	72	156
Common stocks - subsidiaries and affiliates	244	-	165	409
Common stocks - unaffiliated	195	-	308	503
Derivatives:				
Interest rate swaps	-	6,879	-	6,879
Options	-	925	-	925
Currency swaps	-	879	-	879
Interest rate caps and floors	-	18	-	18
Forward contracts	-	109	-	109
Financial futures	-	248	-	248
Separate account assets	43,868	24,890	551	69,309
Total financial assets carried at fair value	$ 44,317	$ 34,063	$ 1,164	$ 79,544
Financial liabilities:				
Derivatives:				
Interest rate swaps	$ -	$ 5,022	$ -	$ 5,022
Options	-	5	-	5
Currency swaps	-	239	-	239
Forward contracts	-	13	-	13
Financial futures	-	15	-	15
Total financial liabilities carried at fair value	$ -	$ 5,294	$ -	$ 5,294

The Company reviews the fair value hierarchy classifications each reporting period. Changes in the observability of the valuation attributes and the level of market activity may result in a reclassification of certain financial assets or liabilities between fair value hierarchy classifications. Such reclassifications are reported as transfers between levels in the beginning fair value for the reporting period in which the changes occur.

Valuation Techniques and Inputs

The Company determines the fair value of its investments using primarily the market approach or the income approach. The use of quoted prices for identical assets and matrix pricing or other similar techniques are examples of market approaches, while the use of discounted cash flow methodologies is an example of the income approach. The Company attempts to maximize the use of observable inputs and minimize the use of unobservable inputs in selecting whether the market or the income approach is used.

A description of the significant valuation techniques and inputs to the determination of estimated fair value for the more significant asset and liability classes measured at fair value on a recurring basis and categorized within Level 2 and Level 3 of the fair value hierarchy is as follows:

Separate account assets – These assets primarily include bonds (industrial and miscellaneous; U.S. government and agencies), and derivatives. Their fair values are determined as follows:

> *Bonds (Industrial and miscellaneous)* – These securities are principally valued using the market or the income approaches. Level 2 valuations are based primarily on quoted prices in markets that are not active, broker quotes, matrix pricing or other similar techniques that use standard market observable inputs such as benchmark yields, spreads versus benchmark yields, new issuances, issuer ratings, duration, and trades of identical or comparable securities. Privately placed securities are valued using discounted cash flow models using standard market observable inputs and inputs derived from, or corroborated by, market observable data including market yield curve, duration, call provisions, observable prices and spreads for similar publicly traded or privately traded issuances that incorporate the credit quality and industry sector of the issuer. This level also includes securities priced by independent pricing services that use observable inputs. Valuations based on matrix pricing or other similar techniques that utilize significant unobservable inputs or inputs that cannot be derived principally from, or corroborated by, observable market data, including adjustments for illiquidity, delta spread adjustments or spreads to reflect industry trends or specific credit-related issues are classified as Level 3. In addition, inputs including quoted prices for identical or similar securities that are less liquid and based on lower levels of trading activity than securities classified in Level 2 are classified as Level 3.
>
> *Bonds (U.S. government and agencies)* – These securities are principally valued using the market approach. Level 2 valuations are based primarily on quoted prices in markets that are not active, or using matrix pricing or other similar techniques using standard market observable inputs such as the benchmark U.S. Treasury yield curve, the spreads versus the U.S. Treasury yield curve for the identical security and comparable securities that are actively traded.

Derivative assets and liabilities – These financial instruments are primarily valued using the market approach. The estimated fair value of derivatives is based primarily on quotations obtained from counterparties and independent sources, such as quoted market values received from brokers. These quotations are compared to internally derived prices and a price challenge is lodged with the counterparties and an independent source when a significant difference cannot be explained by appropriate adjustments to the internal model. When quoted market values are not reliable or available, the value is based upon an internal valuation process using market observable inputs that other market participants would use. Significant inputs to the valuation of derivative financial instruments include overnight index swaps (OIS) and LIBOR basis curves, interest rate volatility, swap yield curve, currency spot rates, cross currency basis curves and dividend yields. Due to the observability of the significant inputs to these fair value measurements, they are classified as Level 2.

The use of different assumptions or valuation methodologies may have a material impact on the estimated fair value amounts. For the periods presented, there were no significant changes to the Company's valuation techniques.

The following presents changes in the Company's Level 3 assets carried at fair value:

	Balance as of 1/1/19	Gains (Losses) in Net Income	Losses (Gains) in Surplus	Purchases	Issuances	Sales	Settlements	Transfers In	Transfers Out	Other	Balance as of 12/31/19
	(In Millions)										
Financial assets:											
Bonds:											
Industrial and miscellaneous	$ 68	$ (2)	$ (2)	$ 28	$ 1	$ -	$ (5)	$ 2	$ -	$ 30	$ 120
Parent, subsidiaries, and affiliates	72	-	-	-	-	-	-	-	(8)	(64)	-
Preferred stocks	-	-	(1)	2	-	-	-	-	-	12	13
Common stocks - subsidiaries and affiliates	165	1	(41)	1	-	-	(6)	-	-	-	120
Common stocks - unaffiliated	308	19	10	5	-	(60)	(10)	-	-	-	272
Separate account assets	551	42	-	797	-	(423)	-	-	-	-	967
Total financial assets	$ 1,164	$ 60	$ (34)	$ 833	$ 1	$ (483)	$ (21)	$ 2	$ (8)	$ (22)	$ 1,492

	Balance as of 1/1/18	Gains (Losses) in Net Income	Losses (Gains) in Surplus	Purchases	Issuances	Sales	Settlements	Transfers In	Transfers Out	Other	Balance as of 12/31/18
	(In Millions)										
Financial assets:											
Bonds:											
Industrial and miscellaneous	$ 57	$ (4)	$ (6)	$ -	$ 1	$ -	$ (10)	$ -	$ -	$ 30	$ 68
Parent, subsidiaries, and affiliates	67	4	(7)	9	-	-	(6)	5	-	-	72
Preferred stocks	2	-	(1)	-	1	-	-	-	-	(2)	-
Common stocks - subsidiaries and affiliates	109	-	43	5	6	-	(11)	9	-	4	165
Common stocks - unaffiliated	314	7	12	17	4	-	(46)	-	-	-	308
Derivatives:											
Currency swaps	1	-	-	-	-	-	-	-	(1)	-	-
Separate account assets	710	7	-	112	-	(278)	-	-	-	-	551
Total financial assets	$ 1,260	$ 14	$ 41	$ 143	$ 12	$ (278)	$ (73)	$ 14	$ (1)	$ 32	$ 1,164
Financial liabilities											
Derivatives:											
Currency swaps	$ 8	-	-	-	-	-	-	-	(8)	-	$ -

Other transfers include assets that are either no longer carried at fair value, or have just begun to be carried at fair value, such as assets with no level changes but a change in the lower of cost or market carrying basis. Industrial and miscellaneous bonds in other contain assets that are now carried at fair value due to ratings changes and assets are no longer carried at fair value where the fair value is now higher than the book value.

Level 3 transfers in are assets that are consistently carried at fair value but have had a level change. Common stocks unaffiliated assets were transferred from Level 2 to Level 3 due to a change in the observability of pricing inputs, at the beginning fair value for the reporting period.

5. *Investments*

The Company maintains a diversified investment portfolio. Investment policies limit concentration in any asset class, geographic region, industry group, economic characteristic, investment quality or individual investment.

a. Bonds

The carrying value and fair value of bonds were as follows:

	December 31, 2019			
	Carrying Value	Gross Unrealized Gains	Gross Unrealized Losses	Fair Value
	(In Millions)			
U.S. government and agencies	$ 4,405	$ 585	$ 2	$ 4,988
All other governments	1,590	174	1	1,763
States, territories and possessions	576	60	-	636
Political subdivisions	535	54	-	589
Special revenue	5,921	805	2	6,724
Industrial and miscellaneous	86,293	6,190	290	92,193
Parent, subsidiaries and affiliates	6,703	163	-	6,866
Total	$ 106,023	$ 8,031	$ 295	$ 113,759

The December 31, 2019 gross unrealized losses exclude $27 million of losses included in the carrying value. These losses include $26 million from NAIC Class 6 bonds and $1 million from RMBS and CMBS whose ratings were obtained from third-party modelers. These losses were primarily included in industrial and miscellaneous or parent, subsidiaries and affiliates.

	December 31, 2018			
	Carrying Value	Gross Unrealized Gains	Gross Unrealized Losses	Fair Value
	(In Millions)			
U.S. government and agencies	$ 6,167	$ 361	$ 21	$ 6,507
All other governments	1,488	30	35	1,483
States, territories and possessions	643	37	2	678
Political subdivisions	565	28	3	590
Special revenue	6,045	527	23	6,549
Industrial and miscellaneous	78,818	1,422	1,996	78,244
Parent, subsidiaries and affiliates	7,778	120	71	7,827
Total	$ 101,504	$ 2,525	$ 2,151	$ 101,878

The December 31, 2018 gross unrealized losses exclude $31 million of losses included in the carrying value. These losses include $31 million from NAIC Class 6 bonds and were primarily included in industrial and miscellaneous or parent, subsidiaries and affiliates.

The quality of the bond portfolio is determined by the use of SVO ratings and the equivalent rating agency designations, except for RMBS and CMBS that use third-party modelers. The following sets forth the NAIC class ratings for the bond portfolio including RMBS and CMBS:

		December 31,			
		2019		2018	
NAIC Class	Equivalent Rating Agency Designation	Carrying Value	% of Total	Carrying Value	% of Total
		($ In Millions)			
1	Aaa/Aa/A	$ 54,777	52 %	$ 55,933	55 %
2	Baa	40,361	38	38,415	38
3	Ba	6,526	6	2,977	3
4	B	1,808	2	2,132	2
5	Caa and lower	2,050	2	1,674	2
6	In or near default	501	-	373	-
	Total	$ 106,023	100 %	$ 101,504	100 %

The following summarizes NAIC ratings for RMBS and CMBS investments subject to NAIC modeling:

	December 31,							
	2019				2018			
	RMBS		CMBS		RMBS		CMBS	
NAIC Class	Carrying Value	% of Total	Carrying Value	% of Total	Carrying Value	% of Total	Carrying Value	% of Total
	($ In Millions)							
1	$ 1,131	92 %	$ 2,659	88 %	$ 1,006	100 %	$ 2,300	95 %
2	92	8	220	7	-	-	26	1
3	-	-	48	2	-	-	-	-
4	-	-	22	1	-	-	11	1
5	-	-	36	1	-	-	48	2
6	-	-	40	1	-	-	24	1
	$ 1,223	100 %	$ 3,025	100 %	$ 1,006	100 %	$ 2,409	100 %

The following is a summary of the carrying value and fair value of bonds as of December 31, 2019 by contractual maturity. Expected maturities may differ from contractual maturities because issuers may have the right to call or prepay obligations with or without prepayment penalties. Securities with more than one maturity date are included in the table using the final maturity date.

	Carrying Value	Fair Value
	(In Millions)	
Due in one year or less	$ 2,932	$ 2,962
Due after one year through five years	22,306	23,032
Due after five years through ten years	23,887	25,439
Due after ten years	56,898	62,326
Total	$ 106,023	$ 113,759

Sales proceeds and related gross realized capital gains (losses) from bonds were as follows:

	Years Ended December 31, 2019	2018
	(In Millions)	
Proceeds from sales	$ 14,315	$ 11,079
Gross realized capital gains from sales	263	160
Gross realized capital losses from sales	(102)	(206)

The following is a summary of the fair values and gross unrealized losses aggregated by bond category and length of time that the securities were in a continuous unrealized loss position:

	December 31, 2019					
	Less Than 12 Months			12 Months or Longer		
	Fair Value	Unrealized Losses	Number of Issuers	Fair Value	Unrealized Losses	Number of Issuers
	($ In Millions)					
U.S. government and agencies	$ 49	$ 1	6	$ 50	$ 1	6
All other governments	32	-	10	16	-	5
States, territories and possessions	48	-	5	-	-	-
Political subdivisions	6	-	3	-	-	-
Special revenue	88	1	36	27	1	12
Industrial and miscellaneous	5,122	84	704	7,974	234	560
Parent, subsidiaries and affiliates	155	-	1	13	-	1
Total	$ 5,500	$ 86	765	$ 8,080	$ 236	584

The December 31, 2019 gross unrealized losses include $27 million of losses included in the carrying value. These losses include $26 million from NAIC Class 6 bonds and $1 million from RMBS and CMBS whose ratings were obtained from third-party modelers. These losses were primarily included in industrial and miscellaneous or parent, subsidiaries and affiliates.

	December 31, 2018					
	Less Than 12 Months			12 Months or Longer		
	Fair Value	Unrealized Losses	Number of Issuers	Fair Value	Unrealized Losses	Number of Issuers
	($ In Millions)					
U.S. government and agencies	$ 10	$ -	7	$ 1,501	$ 21	14
All other governments	585	20	35	256	16	22
States, territories and possessions	9	-	2	90	2	5
Political subdivisions	25	-	5	117	2	7
Special revenue	369	5	52	537	18	96
Industrial and miscellaneous	30,487	902	1,779	17,424	1,107	1,147
Parent, subsidiaries and affiliates	2,173	38	26	3,791	51	8
Total	$ 33,658	$ 965	1,906	$ 23,716	$ 1,217	1,299

The December 31, 2018 gross unrealized losses include $31 million of losses included in the carrying value. These losses include $31 million from NAIC Class 6 bonds and were primarily included in industrial and miscellaneous or parent, subsidiaries and affiliates.

As of December 31, 2019 and 2018, management has not deemed these unrealized losses to be other than temporary because the investment’s carrying value is expected to be realized and the Company has the ability and intent not to sell these investments until recovery, which may be at maturity.

As of December 31, 2019, investments in structured and loan-backed securities that had unrealized losses, which were not recognized in earnings, had a fair value of $7,822 million. Securities in an unrealized loss position for less than 12 months had a fair value of $2,338 million and unrealized losses of $24 million. Securities in an unrealized loss position for greater than 12 months had a fair value of $5,484 million and unrealized losses of $96 million. These securities were primarily categorized as industrial and miscellaneous or parent, subsidiaries and affiliates.

As of December 31, 2018, investments in structured and loan-backed securities that had unrealized losses, which were not recognized in earnings, had a fair value of $10,528 million. Securities in an unrealized loss position for less than 12 months had a fair value of $8,248 million and unrealized losses of $148 million. Securities in an unrealized loss position for greater than 12 months had a fair value of $2,280 million and unrealized losses of $84 million. These securities were primarily categorized as industrial and miscellaneous or parent, subsidiaries and affiliates.

In the course of the Company’s investment management activities, securities may be sold and reacquired within 30 days to enhance the Company’s yield on its investment portfolio. The Company did not sell any securities with the NAIC Designation 3 or below for the years ended December 31, 2019 or 2018, that were reacquired within 30 days of the sale date.

The Company had assets on deposit with government authorities or trustees, as required by law, in the amount of $17 million as of December 31, 2019, and $16 million as of December 31, 2018.

Residential mortgage-backed exposure

Residential mortgage-backed securities (RMBS) are included in the U.S. government and agencies, special revenue and industrial and miscellaneous bond categories. The Alt-A category includes option adjustable-rate mortgages and the subprime category includes 'scratch and dent' or reperforming pools, high loan-to-value pools and pools where the borrowers have very impaired credit but the average loan-to-value is low, typically 70% or below. In identifying Alt-A and subprime exposure, management used a combination of qualitative and quantitative factors, including FICO scores and loan-to-value ratios.

As of December 31, 2019, RMBS had a total carrying value of $1,823 million and a fair value of $1,939 million, of which approximately 19%, based on carrying value, was classified as Alt-A. Alt-A and subprime RMBS had a total carrying value of $904 million and a fair value of $969 million. As of December 31, 2018, RMBS had a total carrying value of $1,338 million and a fair value of $1,451 million, of which approximately 21%, based on carrying value, was classified as Alt-A. Alt-A and subprime RMBS had a total carrying value of $499 million and a fair value of $583 million.

During the year ended December 31, 2019, there were no significant credit downgrades for the securities held by the Company that were backed by residential mortgage pools.

Leveraged loan exposure

Leveraged loans are loans extended to companies that already have considerable amounts of debt. The Company reports leveraged loans as bonds. These leveraged loans have interest rates higher than typical loans, reflecting the additional risk of default from issuers with high debt-to-equity ratios.

As of December 31, 2019, total leveraged loans and leveraged loan CDOs had a carrying value of $14,902 million and a fair value of $14,985 million, of which approximately 79%, based on carrying value, were domestic leveraged loans and CDOs. As of December 31, 2018, total leveraged loans and leveraged loan CDOs had a carrying value of $13,129 million and a fair value of $13,041 million, of which approximately 82%, based on carrying value, were domestic leveraged loans and CDOs.

Commercial mortgage-backed exposure

The Company holds bonds backed by pools of commercial mortgages. The mortgages in these pools have varying risk characteristics related to underlying collateral type, borrower's risk profile and ability to refinance and the return provided to the borrower from the underlying collateral. These investments had a carrying value of $3,026 million and fair value of $3,138 million as of December 31, 2019 and a carrying value of $2,425 million and fair value of $2,430 million as of December 31, 2018.

b. Preferred stocks

The carrying value and fair value of preferred stocks were as follows:

	December 31,	
	2019	2018
	(In Millions)	
Carrying value	$ 756	$ 770
Gross unrealized gains	54	29
Gross unrealized losses	(15)	(40)
Fair value	$ 795	$ 759

As of December 31, 2019, investments in preferred stocks in an unrealized loss position included holdings with a fair value of $135 million in 6 issuers, $133 million of which was in an unrealized loss position for more than 12 months. As of December 31, 2018, investments in preferred stocks in an unrealized loss position included holdings with a fair value of $525 million in 33 issuers, $518 million of which was in an unrealized loss position for more than 12 months. Based upon the Company's impairment review process discussed in *Note 2dd. "Net realized capital gains (losses) including other-than-temporary impairments and unrealized capital gains (losses)"* the decline in value of these securities was not considered to be other than temporary as of December 31, 2019 or 2018.

The Company held preferred stocks for which the transfer of ownership was restricted by contractual requirements with carrying values of $691 million as of December 31, 2019 and $687 million as of December 31, 2018.

c. Common stocks – subsidiaries and affiliates

MMHLLC, a wholly-owned subsidiary of MassMutual, is the parent of subsidiaries that include Barings LLC (Barings) and deals in markets that include retail and institutional asset management entities and registered broker dealers.

MassMutual International LLC (MMI), a wholly-owned subsidiary of MassMutual, includes investments in international life insurance companies. On December 31, 2018, MMI was transferred from Common stocks - subsidiaries and affiliates to Partnerships and limited liability companies due to the sale of majority interests in two international life insurance operating subsidiaries in 2018.

The MMHLLC statutory carrying value was $13.9 billion as of December 31, 2019 and $9.3 billion as of December 31, 2018.

Summarized below is certain U.S. GAAP financial information for MMHLLC:

	As of and for the Years Ended December 31,					
	2019			2018		
	(In Billions)					
	Continuing Operations	Discontinued Operations	Total	Continuing Operations	Discontinued Operations	Total
Total revenue	$ 3.6	$ 5.2	$ 8.8	$ 3.1	$ 2.2	$ 5.3
Net income	0.9	3.5	4.4	0.5	0.5	1.0
Assets	22.9	-	22.9	16.5	2.6	19.1
Liabilities	8.3	-	8.3	7.5	0.8	8.3
Member's equity	14.6	-	14.6	10.8	-	10.8

MMHLLC declared $500 million of dividends, of which $300 million was paid to MassMutual for the year ended December 31, 2019 and declared $900 million of dividends, of which $250 million was paid for the year ended December 31, 2018.

MassMutual contributed capital of $290 million to MMHLLC for the year ended December 31, 2019 and $343 million for the year ended December 31, 2018.

On May 24, 2019, an indirectly wholly owned subsidiary of MassMutual, MM Asset Management Holding LLC (MMAMH) executed the sale of its retail asset management affiliate, Oppenheimer Acquisition Corp. (OAC), to Invesco Ltd (Invesco), a global asset manager. Under the terms of the sale, MMAMH and OAC employee shareholders received 81.8 million of Invesco common shares and $4.0 billion in perpetual, non-cumulative preference shares with a fixed cash dividend rate of 5.9%. MMAMH is a directly wholly owned subsidiary of MMHLLC. In turn, at the time of the transaction, MMAMH received a 15.7% common equity interest in post transaction Invesco and MMAMH entered into a shareholder agreement pursuant to which MMAMH has customary minority shareholder rights, including the appointment of a director to Invesco's board of directors. MassMutual's investment in MMHLLC was increased from the impact of this sale through change in unrealized capital gains of $3,361 million, with an approximate net increase to surplus of $2,500 million.

MMI completed the sale of MassMutual Asia Limited (MM Asia) to Yunfeng Financial Group (Yunfeng FG) and several Asia-based investors. Under the terms of the agreement, MMI received $1,012 million in cash and 800 million shares of Yunfeng FG, which represented approximately 24.8% ownership at the time of the close. In turn, Yunfeng FG held, at the time of closing, a 60% interest in MM Asia and the other investors held the remainder. The transaction was signed and announced in August 2017.

In March 2018, MassMutual and MMI entered into an agreement to sell 85.1% of MassMutual Life Insurance Company in Japan (MM Japan), a wholly-owned life insurance and wealth management subsidiary of MMI, to Nippon Life. MMI estimated the fair value of the retained portion of MM Japan based upon an internal valuation model. The sale of MM Japan closed in May 2018. MMI received $960 million in cash proceeds from the sale.

The amount of the proceeds from the sale of MM Japan and MM Asia was less than MMI's book value. As such, MMI's book value was reduced to an estimated fair value of $2,700 million and an impairment of $1,257 million was recorded in net realized capital gains (losses) in 2018.

MassMutual contributed additional capital of $214 million to MMI during the year ended December 31, 2018. During the year ended December 31, 2018, MassMutual received $1,583 million as a return of capital from MMI.

Subsidiaries of MMHLLC are involved in litigation and investigations arising in the ordinary course of their business, which seek compensatory damages, punitive damages and equitable remedies. Although the Company is not aware of any actions or allegations that reasonably could give rise to a material adverse impact to the Company's financial position or liquidity, the outcome of litigation cannot be foreseen with certainty. It is the opinion of management that the ultimate resolution of these matters will not materially impact the Company's financial position or liquidity. However, the outcome of a particular proceeding may be material to the Company's Consolidated Statutory Statements of Changes in Surplus for a particular period depending upon, among other factors, the size of the loss and the level of the Company's changes in surplus for the period.

The Company does not rely on dividends from its subsidiaries to meet its operating cash flow requirements. For the domestic life insurance subsidiaries, substantially all of their statutory shareholder's equity of $1,735 million as of December 31, 2019 was subject to dividend restrictions imposed by the State of Connecticut.

For further information on related party transactions with subsidiaries and affiliates, see *Note 17. "Related party transactions"*.

d. Common stocks – unaffiliated

The adjusted cost basis and carrying value of unaffiliated common stocks were as follows:

	December 31,	
	2019	2018
	(In Millions)	
Adjusted cost basis	$ 1,079	$ 455
Gross unrealized gains	156	85
Gross unrealized losses	(46)	(37)
Carrying value	$ 1,189	$ 503

As of December 31, 2019, investments in unaffiliated common stocks in an unrealized loss position included holdings with a fair value of $273 million in 99 issuers, $124 million of which were in an unrealized loss position for more than 12 months. As of December 31, 2018, investments in unaffiliated common stocks in an unrealized loss position included holdings with a fair value of $98 million in 75 issuers, $51 million of which were in an unrealized loss position for more than 12 months. Based upon the Company's impairment review process discussed in *Note 2dd. "Net realized capital gains (losses) including other-than-temporary impairments and unrealized capital gains (losses)"* the decline in value of these securities was not considered to be other than temporary as of December 31, 2019 or 2018.

The Company held common stocks, for which the transfer of ownership was restricted by contractual requirements, with carrying values of $116 million as of December 31, 2019 and $167 million as of December 31, 2018.

e. Mortgage loans

Mortgage loans comprised commercial mortgage loans and residential mortgage loans. The Company's commercial mortgage loans primarily finance various types of real estate properties throughout the U.S., the United Kingdom and Canada. The Company holds commercial mortgage loans for which it is the primary lender or a participant or co-lender in a mortgage loan agreement and mezzanine loans that are subordinate to senior secured first liens. The Company's loan agreements with the senior lender contain negotiated provisions that are designed to maximize the Company's influence with the objective of mitigating the Company's risks as the secondary lender for mezzanine loans. Commercial mortgage loans have varying risk characteristics including, among others, the borrower's liquidity, the underlying percentage of completion of a project, the returns generated by the collateral, the refinance risk associated with maturity of the loan and deteriorating collateral value.

Residential mortgage loans include seasoned pools of homogeneous residential mortgage loans substantially backed by Federal Housing Administration (FHA) and Veterans Administration (VA) guarantees. As of December 31, 2019 and 2018, the Company did not have any direct subprime exposure through the purchases of unsecuritized whole-loan pools.

Geographical concentration is considered prior to the purchase of mortgage loans and residential mortgage loan pools. The mortgage loan portfolio is diverse with no significant collateral concentrations in any particular geographic region as of December 31, 2019 or 2018.

The carrying value and fair value of the Company's mortgage loans were as follows:

	December 31, 2019		December 31, 2018	
	Carrying Value	Fair Value	Carrying Value	Fair Value
	(In Millions)			
Commercial mortgage loans:				
Primary lender	$ 24,993	$ 25,957	$ 23,094	$ 23,547
Mezzanine loans	-	-	75	76
Total commercial mortgage loans	24,993	25,957	23,169	23,623
Residential mortgage loans:				
FHA insured and VA guaranteed	2,684	2,673	1,374	1,311
Other residential loans	731	734	5	5
Total residential mortgage loans	3,415	3,407	1,379	1,316
Total mortgage loans	$ 28,408	$ 29,364	$ 24,548	$ 24,939

As of December 31, 2019 and December 31, 2018, the loan-to-value ratios of 99% of the Company's commercial mortgage loans were less than 81%.

The Company uses an internal rating system as its primary method of monitoring credit quality. The following illustrates the Company's mortgage loan portfolio rating, translated into the equivalent rating agency designation:

	December 31, 2019					
	AAA/AA/A	BBB	BB	B	CCC and Lower	Total
	(In Millions)					
Commercial mortgage loans:						
Primary lender	$ 12,582	$ 10,742	$ 1,509	$ 129	$ 31	$ 24,993
Mezzanine loans	-	-	-	-	-	-
Total commercial mortgage loans	12,582	10,742	1,509	129	31	24,993
Residential mortgage loans:						
FHA insured and VA guaranteed	2,684	-	-	-	-	2,684
Other residential loans	68	663	-	-	-	731
Total residential mortgage loans	2,752	663	-	-	-	3,415
Total mortgage loans	$ 15,334	$ 11,405	$ 1,509	$ 129	$ 31	$ 28,408

	December 31, 2018					
	AAA/AA/A	BBB	BB	B	CCC and Lower	Total
	(In Millions)					
Commercial mortgage loans:						
Primary lender	$ 11,335	$ 10,644	$ 902	$ 182	$ 31	$ 23,094
Mezzanine loans	-	-	75	-	-	75
Total commercial mortgage loans	11,335	10,644	977	182	31	23,169
Residential mortgage loans:						
FHA insured and VA guaranteed	1,374	-	-	-	-	1,374
Other residential loans	5	-	-	-	-	5
Total residential mortgage loans	1,379	-	-	-	-	1,379
Total mortgage loans	$ 12,714	$ 10,644	$ 977	$ 182	$ 31	$ 24,548

More than 99% of the Company's commercial mortgage loans' loan-to-value ratios are below 81%.

The maximum percentage of any one commercial mortgage loan to the estimated value of secured collateral at the time the loan was originated, exclusive of mezzanine, insured, guaranteed or purchase money mortgages, was 81.2% as of December 31, 2019 and 81.6% as of December 31, 2018.

The geographic distribution of commercial mortgage loans was as follows:

	December 31, 2019	
	Carrying Value	Average Loan-to-Value Ratio
	($ In Millions)	
California	$ 5,915	48 %
New York	2,488	49 %
Illinois	2,236	52 %
United Kingdom	2,506	51 %
Texas	2,019	53 %
Washington	1,561	49 %
District of Columbia	1,238	52 %
All other	7,030	53 %
Total commercial mortgage loans	$ 24,993	51 %

All other consists of 30 jurisdictions, with no individual exposure exceeding $986 million.

	December 31, 2018	
	Carrying Value	Average Loan-to-Value Ratio
	($ In Millions)	
California	$ 5,533	49 %
New York	2,560	49 %
United Kingdom	2,075	48 %
Illinois	2,014	49 %
Texas	1,877	55 %
Washington	1,430	47 %
District of Columbia	1,186	55 %
All other	6,494	52 %
Total commercial mortgage loans	$ 23,169	50 %

All other consists of 28 jurisdictions, with no individual exposure exceeding $818 million.

Interest rates, including fixed and variable, on the Company's portfolio of mortgage loans were:

	Years Ended December 31, 2019		2018	
	Low	High	Low	High
Commercial mortgage loans	3.0 %	10.0 %	3.1 %	10.6 %
Residential mortgage loans	3.3 %	10.0 %	3.0 %	11.4 %
Mezzanine mortgage loans	- %	- %	11.4 %	12.0 %

Interest rates, including fixed and variable, on new mortgage loans were:

	Years Ended December 31, 2019		2018	
	Low	High	Low	High
Commercial mortgage loans	3.0 %	8.7 %	3.7 %	8.9 %
Residential mortgage loans	4.2 %	6.1 %	3.7 %	4.6 %

As of December 31, 2019 and 2018 the Company had no impaired mortgage loans with or without a valuation allowance, or mortgage loans derecognized as a result of foreclosure, including mortgage loans subject to a participant or co-lender mortgage loan agreement with a unilateral mortgage loan foreclosure restriction.

As of and for the years ended December 31, 2019 and 2018, the Company had no valuation allowance recorded for commercial mortgage loans.

The Company did not hold any restructured mortgage loans, mortgage loans with principal or interest past due, or mortgage loans with suspended interest accruals as of December 31, 2019 or 2018. The carrying value of commercial mortgage loans subject to a participant or co-lender mortgage loan agreement was $657 million as of December 31, 2019 and $665 million as of December 31, 2018.

f. Real estate

The carrying value of real estate was as follows:

	December 31, 2019	December 31, 2018
	(In Millions)	
Held for the production of income	$ 1,784	$ 1,898
Accumulated depreciation	(711)	(721)
Encumbrances	(924)	(904)
Held for the production of income, net	149	273
Held for sale	-	48
Accumulated depreciation	-	(1)
Encumbrances	-	(27)
Held for sale, net	-	20
Occupied by the Company	441	411
Accumulated depreciation	(232)	(216)
Occupied by the Company, net	209	195
Total real estate	$ 358	$ 488

Depreciation expense on real estate was $91 million for the year ended December 31, 2019 and $84 million for the year ended December 31, 2018.

g. Partnerships and limited liability companies

The carrying value of partnership and limited liability companies holdings by annual statement category were:

	December 31, 2019	December 31, 2018
	(In Millions)	
Joint venture interests:		
Common stocks - subsidiaries and affiliates	$ 3,144	$ 3,125
Common stocks - unaffiliated	2,164	2,022
Real estate	1,232	1,363
Bonds/preferred stock	1,068	961
Other	286	289
LIHTCs	242	288
Mortgage loans	673	409
Surplus notes	363	311
Total	$ 9,172	$ 8,768

The Company held three affiliated partnerships and limited liability companies in a loss position with accumulated losses of $60 million as of December 31, 2019, and nine affiliated partnerships and LLCs in a loss position with accumulated losses of $43 million, as of December 31, 2018.

The Company’s unexpired tax credits expire within a range of less than 1 year to 15 years.

The Company recorded tax credits on these investments of $45 million for the year ended December 31, 2019 and $47 million for the year ended December 31, 2018. The minimum holding period required for the Company's LIHTC investments extends from 1 year to 15 years.

For determining impairments for LIHTC investments, the Company uses the present value of all future benefits, the majority of which are tax credits, discounted at a risk-free rate ranging from 1.51% for future benefits of two years to 1.82% for future benefits of ten or more years, and compares the result to its current carry value. The Company recorded impairments of $2 million for the year ended December 31, 2019. LIHTC impairments of $5 million were recorded for the year ended December 31, 2018.

There were no write-downs or reclassifications of LIHTC partnerships made during the fourth quarter ended December 31, 2019 or December 31, 2018 due to forfeiture or ineligibility of tax credits or similar issues. There are no LIHTC investments subject to regulatory review for the years ended December 31, 2019 or 2018.

h. Derivatives

The Company uses derivative financial instruments in the normal course of business to manage risks, primarily to reduce currency, interest rate and duration imbalances determined in asset/liability analyses. The Company also uses a combination of derivatives and fixed income investments to create synthetic investments. These synthetic investments are created when they are economically more attractive than the actual instrument or when similar instruments are unavailable. Synthetic investments are created either to hedge and reduce the Company's credit exposure or to create an investment in a particular asset. The Company held synthetic investments with a notional amount of $18,039 million as of December 31, 2019 and $15,582 million as of December 31, 2018. These notional amounts included replicated asset transaction values of $16,039 million as of December 31, 2019 and $13,582 million as of December 31, 2018, as defined under statutory accounting practices as the result of pairing of a long derivative contract with cash instruments.

The Company's derivative strategy employs a variety of derivative financial instruments, including: interest rate, currency, equity, bond, and credit default swaps; options; forward contracts and financial futures. Investment risk is assessed on a portfolio basis and individual derivative financial instruments are not generally designated in hedging relationships; therefore, as allowed by statutory accounting practices, the Company intentionally has not applied hedge accounting.

Interest rate swaps are primarily used to more closely match the cash flows of assets and liabilities. Interest rate swaps are also used to mitigate changes in the value of assets anticipated to be purchased and other anticipated transactions and commitments. The Company uses currency swaps for the purpose of managing currency exchange risks in its assets and liabilities.

The Company does not sell credit default swaps as a participant in the credit insurance market. The Company does, however, use credit default swaps as part of its investment management process. The Company buys credit default swaps as an efficient means to reduce credit exposure to particular issuers or sectors in the Company's investment portfolio. The Company sells credit default swaps in order to create synthetic investment positions that enhance the return on its investment portfolio by providing comparable exposure to fixed income securities that might not be available in the primary market.

Options grant the purchaser the right to buy or sell a security or enter a derivative transaction at a stated price within a stated period. The Company's option contracts have terms of up to 15 years. A swaption is an option to enter an interest rate swap to either receive or pay a fixed rate at a future date. The Company purchases these options for the purpose of managing interest rate risks in its assets and liabilities.

The Company adopted a clearly defined hedging strategy (CDHS) to enable the Company to incorporate currently +held hedges in risk-based capital (RBC) calculations. The CDHS is used to significantly mitigate the impact that movements in capital markets have on the liabilities associated with annuity guarantees. The hedge portfolio consists mainly of interest rate swaps, equity swaps, interest rate swaptions and equity futures, and provides protection in the stress scenarios under which RBC is calculated. The hedge portfolio has offsetting impacts relative to the total asset requirement for RBC and surplus for GMDB and VAGLB.

The Company utilizes certain other agreements including forward contracts and financial futures. In addition, the Company also uses "to be announced" forward contracts (TBAs) to hedge interest rate risk and participate in the mortgage-backed securities market in an efficient and cost effective way. Typically, the price is agreed upon at contract inception and payment is made at a specified future date. The Company usually does not purchase TBAs with settlement by the first possible delivery date and thus, accounts for these TBAs as derivatives. TBAs that settle on the first possible delivery date are accounted for as bonds. The Company's futures contracts are exchange traded and have credit risk. Margin requirements are met with the deposit of securities. Futures contracts are generally settled with offsetting transactions. Forward contracts and financial futures are used by the Company to reduce exposures to various risks including interest rates and currency rates.

The Company's principal derivative exposures to market risk are interest rate risk, which includes inflation and credit risk. Interest rate risk pertains to the change in fair value of the derivative instruments as a result of changes in market interest rates. The Company is exposed to credit-related losses in the event of nonperformance by counterparties to derivative financial instruments. The Company regularly monitors counterparty credit ratings, derivative positions, valuations and the value of collateral posted to ensure counterparties are credit-worthy and the concentration of exposure is minimized, and monitors its derivative credit exposure as part of its overall risk management program.

The Company enters derivative transactions through bilateral derivative agreements with counterparties, or through over the counter cleared derivatives with a counterparty and the use of a clearinghouse. To minimize credit risk for bilateral transactions, the Company and its counterparties generally enter into master netting agreements based on agreed upon requirements that outline the framework for how collateral is to be posted in the amount owed under each transaction, subject to certain minimums. For over the counter cleared derivative transactions between the Company and a counterparty, the parties enter into a series of master netting and other agreements that govern, among other things, clearing and collateral requirements. These transactions are cleared through a clearinghouse and each derivative counterparty is only exposed to the default risk of the clearinghouse. Certain interest rate swaps and credit default swaps are considered cleared transactions. These cleared transactions require initial and daily variation margin collateral postings. These agreements allow for contracts in a positive position, in which amounts are due to the Company, to be offset by contracts in a negative position. This right of offset, combined with collateral obtained from counterparties, reduces the Company's credit exposure.

Net collateral pledged by the counterparties was $2,146 million as of December 31, 2019 and $2,377 million as of December 31, 2018. In the event of default, the full market value exposure at risk in a net gain position, net of offsets and collateral, was $54 million as of December 31, 2019 and $152 million as of December 31, 2018. The statutory net amount at risk, defined as net collateral pledged and statement values excluding accrued interest, was $421 million as of December 31, 2019 and $701 million as of December 31, 2018.

The Company had the right to rehypothecate or repledge securities totaling $1,136 million of the $2,146 million as of December 31, 2019 and $709 million of the $2,377 million as of December 31, 2018 of net collateral pledged by counterparties. There were no securities rehypothecated to other counterparties as of December 31, 2019 or December 31, 2018.

The following summarizes the carrying values and notional amounts of the Company’s derivative financial instruments:

	December 31, 2019			
	Assets		Liabilities	
	Carrying Value	Notional Amount	Carrying Value	Notional Amount
	(In Millions)			
Interest rate swaps	$ 11,037	$ 94,955	$ 9,684	$ 119,053
Options	605	19,710	10	272
Currency swaps	915	11,124	216	5,634
Forward contracts	12	2,289	162	8,301
Credit default swaps	22	1,185	-	35
Financial futures	6	291	129	3,424
Total	$ 12,597	$ 129,554	$ 10,201	$ 136,719

	December 31, 2018			
	Assets		Liabilities	
	Carrying Value	Notional Amount	Carrying Value	Notional Amount
	(In Millions)			
Interest rate swaps	$ 6,879	$ 94,813	$ 5,022	$ 91,272
Options	925	19,932	5	128
Currency swaps	879	9,314	239	4,152
Interest rate caps and floors	18	8,465	-	-
Forward contracts	109	6,905	13	3,738
Credit default swaps	18	1,135	2	105
Financial futures	248	3,486	15	291
Total	$ 9,076	$ 144,050	$ 5,296	$ 99,686

The average fair value of outstanding derivative assets was $12,852 million for the year ended December 31, 2019 and $8,931 million for the year ended December 31, 2018. The average fair value of outstanding derivative liabilities was $9,240 million for the year ended December 31, 2019 and $5,843 million for the year ended December 31, 2018.

The following summarizes the notional amounts of the Company's credit default swaps by contractual maturity:

	December 31, 2019	December 31, 2018
	(In Millions)	
Due in one year or less	$ 10	$ 20
Due after one year through five years	1,210	1,220
Total	$ 1,220	$ 1,240

The following presents the Company's gross notional interest rate swap positions:

	December 31, 2019	December 31, 2018
	(In Millions)	
Open interest rate swaps in a fixed pay position	$ 99,985	$ 97,091
Open interest rate swaps in a fixed receive position	110,403	87,530
Other interest related swaps	3,620	1,465
Total interest rate swaps	$ 214,008	$ 186,086

The following summarizes the Company's net realized gains (losses) on closed contracts and change in net unrealized gains (losses) related to market fluctuations on open contracts by derivative type:

	Years Ended December 31,			
	2019		2018	
	Net Realized Gains (Losses) on Closed Contracts	Change In Net Unrealized Gains (Losses) on Open Contracts	Net Realized Gains (Losses) on Closed Contracts	Change In Net Unrealized Gains (Losses) on Open Contracts
	(In Millions)			
Interest rate swaps	$ 170	$ (503)	$ (106)	$ (432)
Currency swaps	26	60	41	823
Options	(29)	(264)	(41)	107
Credit default swaps	13	-	12	2
Interest rate caps and floors	-	(6)	(3)	6
Forward contracts	238	(245)	183	176
Financial futures	637	(357)	(370)	232
Total	$ 1,055	$ (1,315)	$ (284)	$ 914

The following summarizes gross and net information of derivative assets and liabilities, along with collateral posted in connection with master netting agreements:

	December 31, 2019			December 31, 2018		
	Derivative Assets	Derivative Liabilities	Net	Derivative Assets	Derivative Liabilities	Net
	(In Millions)					
Gross	$ 12,597	$ 10,201	$ 2,396	$ 9,076	$ 5,296	$ 3,780
Due and accrued	843	2,003	(1,160)	872	1,997	(1,125)
Gross amounts offset	(9,983)	(9,983)	-	(6,378)	(6,378)	-
Net asset	3,457	2,221	1,236	3,570	915	2,655
Collateral posted	(4,531)	(2,385)	(2,146)	(3,733)	(1,356)	(2,377)
Net	$ (1,074)	$ (164)	$ (910)	$ (163)	$ (441)	$ 278

i. Repurchase agreements

The Company had repurchase agreements with carrying values of $3,834 million as of December 31, 2019 and $5,001 million as of December 31, 2018. As of December 31, 2019, the maturities of these agreements ranged from January 3, 2020 through February 14, 2020 and the interest rates ranged from 1.78% to 2.05%. The outstanding amounts were collateralized by cash and bonds with a carrying value of $3,846 million as of December 31, 2019 and $5,030 million as of December 31, 2018.

j. Net investment income

Net investment income, including IMR amortization, comprised the following:

	Year Ended December 31, 2019	2018
	(In Millions)	
Bonds	$ 4,625	$ 4,271
Preferred stocks	39	36
Common stocks - subsidiaries and affiliates	503	910
Common stocks - unaffiliated	40	44
Mortgage loans	1,124	1,038
Policy loans	940	869
Real estate	128	110
Partnerships and limited liability companies	917	1,063
Derivatives	349	334
Cash, cash equivalents and short-term investments	86	76
Other	51	8
Subtotal investment income	8,802	8,759
Amortization of the IMR	11	71
Investment expenses	(805)	(743)
Net investment income	$ 8,008	$ 8,087

k. Net realized capital (losses) gains

Net realized capital losses, which include OTTI and are net of deferral to the IMR, comprised the following:

	Years Ended December 31, 2019	Years Ended December 31, 2018
	(In Millions)	
Bonds	$ 47	$ (173)
Preferred stocks	1	-
Common stocks - subsidiaries and affiliates	1	(1,241)
Common stocks - unaffiliated	31	92
Mortgage loans	3	(2)
Real estate	33	168
Partnerships and limited liability companies	37	(58)
Derivatives	1,055	(284)
Other	(1)	(28)
Net realized capital gains (losses) before federal and state taxes and deferral to the IMR	1,207	(1,526)
Net federal and state tax (expense) benefit	(118)	43
Net realized capital gains (losses) before deferral to the IMR	1,089	(1,483)
Net after tax (gains) losses deferred to the IMR	(1,133)	439
Net realized capital losses	$ (44)	$ (1,044)

The IMR liability balance was $547 million as of December 31, 2019 and less than $1 million as of December 31, 2018. The IMR liability is included in other liabilities on the Consolidated Statutory Statements of Financial Position. Refer to *Note 2z. "Interest maintenance reserve"* for information on the Company's policy for IMR. Refer to *Note 14. "Surplus notes"* for information on the other realized capital loss.

OTTI, included in the realized capital losses, consisted of the following:

	Years Ended December 31, 2019	Years Ended December 31, 2018
	(In Millions)	
Bonds	$ (114)	$ (128)
Common stocks - subsidiaries and affiliates	-	(1,258)
Common stocks - unaffiliated	(8)	(13)
Partnerships and limited liability companies	(90)	(62)
Total OTTI	$ (212)	$ (1,461)

The Company recognized OTTI of $4 million for the year ended December 31, 2019 and $1 million for the year ended December 31, 2018 on structured and loan-backed securities, which are included in bonds, primarily due to the present value of expected cash flows being less than the amortized cost.

The Company utilized internally-developed models to determine 1% of the $115 million of bond OTTI for the year ended December 31, 2019 and 1% of the $128 million of bond OTTI for the year ended December 31, 2018. The remaining OTTI amounts were determined using external inputs such as publicly-observable fair values and credit ratings. Refer to *Note 2dd. "Net realized capital gains (losses) including other-than-temporary impairments and unrealized capital gains (losses)"* for more information on assumptions and inputs used in the Company's OTTI models.

6. Federal income taxes

On December 22, 2017, the president signed into law H.R. 1/Public Law 115-97, commonly known as the Tax Cuts and Jobs Act. The Act contains several key provisions that have significant financial statement effects in both the current and prior reporting periods. Effective January 1, 2018, the Act reduced the corporate tax rate to 21 percent and eliminated the corporate alternative minimum tax, increased the capitalization rates for determining deferred acquisition costs and extended the amortization period, modified the life company proration rules, reduced the dividends received deduction applicable to corporate shareholders, and modified the net operating loss deduction (NOL) applicable to corporate taxpayers.

The Act revised the computation of life insurance tax reserves to be the greater of the net surrender value of a contract and 92.81 percent of statutory reserves, effective for taxable years beginning after December 31, 2017. A transition rule requires life insurers to evenly spread the difference between the prior year end reserves computed on the old basis and those computed on the new basis over eight years as either income or a deduction. The transition amount, as adjusted, was a net increase to the deferred tax asset (DTA) of $459 million, offset by a corresponding increase in its deferred tax liability.

The Company provides for DTAs in accordance with statutory accounting practices. All of the companies included in these Consolidated Statutory Financial Statements have met the required threshold to utilize the three-year reversal period and 15% of surplus limitation.

The net DTA or (DTL) recognized in the Company's assets, liabilities and surplus is as follows:

	December 31, 2019		
	Ordinary	Capital	Total
	(In Millions)		
Gross DTAs	$ 2,899	$ 156	$ 3,055
Statutory valuation allowance adjustment	-	-	-
Adjusted gross DTAs	2,899	156	3,055
DTAs nonadmitted	(26)	(20)	(46)
Subtotal net admitted DTA	2,873	136	3,009
Total gross DTLs	(1,230)	(639)	(1,869)
Net admitted DTA(L)	$ 1,643	$ (503)	$ 1,140

	December 31, 2018		
	Ordinary	Capital	Total
	(In Millions)		
Gross DTAs	$ 2,757	$ 365	$ 3,122
Statutory valuation allowance adjustment	-	-	-
Adjusted gross DTAs	2,757	365	3,122
DTAs nonadmitted	(63)	(11)	(74)
Subtotal net admitted DTA	2,694	354	3,048
Total gross DTLs	(1,565)	(477)	(2,042)
Net admitted DTA(L)	$ 1,129	$ (123)	$ 1,006

	Change		
	Ordinary	Capital	Total
	(In Millions)		
Gross DTAs	$ 142	$ (209)	$ (67)
Statutory valuation allowance adjustment	-	-	-
Adjusted gross DTAs	142	(209)	(67)
DTAs nonadmitted	37	(9)	28
Subtotal net admitted DTA	179	(218)	(39)
Total gross DTLs	335	(162)	173
Net admitted DTA(L)	$ 514	$ (380)	$ 134

The amount of adjusted gross DTA admitted under each component of the guidance and the resulting change by tax character are as follows:

	December 31, 2019		
	Ordinary	Capital	Total
	(In Millions)		
Admitted DTA 3 years:			
Federal income taxes that can be recovered	$ -	$ 71	$ 71
Remaining adjusted gross DTAs expected			
to be realized within 3 years (lesser of 1 or 2):			
1. Adjusted gross DTA to be realized	1,107	-	1,107
2. Adjusted gross DTA allowed per limitation threshold	2,960	-	2,960
Lesser of lines 1 or 2	1,107	-	1,107
Adjusted gross DTAs offset by existing DTLs	1,766	65	1,831
Total admitted DTA realized within 3 years	$ 2,873	$ 136	$ 3,009

	December 31, 2018		
	Ordinary	Capital	Total
	(In Millions)		
Admitted DTA 3 years:			
Federal income taxes that can be recovered	$ -	$ 55	$ 55
Remaining adjusted gross DTAs expected			
to be realized within 3 years (lesser of 1 or 2):			
1. Adjusted gross DTA to be realized	1,039	-	1,039
2. Adjusted gross DTA allowed per limitation threshold	2,329	-	2,329
Lesser of lines 1 or 2	1,039	-	1,039
Adjusted gross DTAs offset by existing DTLs	1,655	299	1,954
Total admitted DTA realized within 3 years	$ 2,694	$ 354	$ 3,048

	Change		
	Ordinary	Capital	Total
	(In Millions)		
Admitted DTA 3 years:			
Federal income taxes that can be recovered	$ -	$ 16	$ 16
Remaining adjusted gross DTAs expected			
to be realized within 3 years (lesser of 1 or 2):			
1. Adjusted gross DTA to be realized	68	-	68
2. Adjusted gross DTA allowed per limitation threshold	631	-	631
Lesser of lines 1 or 2	68	-	68
Adjusted gross DTAs offset by existing DTLs	111	(234)	(123)
Total admitted DTA realized within 3 years	$ 179	$ (218)	$ (39)

The ultimate realization of DTAs depends on the generation of future taxable income during the periods in which the temporary differences are deductible. Management considers the scheduled reversal of DTLs, including the impact of available carryback and carryforward periods, projected taxable income and tax-planning strategies in making this assessment. The impact of tax-planning is as follows:

	December 31, 2019		
	Ordinary	Capital	Total
	(Percent)		
Impact of tax-planning strategies:			
Adjusted gross DTAs			
(% of total adjusted gross DTAs)	- %	- %	- %
Net admitted adjusted gross DTAs			
(% of total net admitted adjusted gross DTAs)	45 %	- %	45 %

	December 31, 2018		
	Ordinary	Capital	Total
	(Percent)		
Impact of tax-planning strategies:			
Adjusted gross DTAs			
(% of total adjusted gross DTAs)	- %	- %	- %
Net admitted adjusted gross DTAs			
(% of total net admitted adjusted gross DTAs)	76 %	- %	76 %

	Change		
	Ordinary	Capital	Total
	(Percent)		
Impact of tax-planning strategies:			
Adjusted gross DTAs			
(% of total adjusted gross DTAs)	- %	- %	- %
Net admitted adjusted gross DTAs			
(% of total net admitted adjusted gross DTAs)	(31)%	- %	(31)%

There are no reinsurance strategies included in the Company's tax-planning strategies.

The provision for current tax expense on earnings is as follows:

	Years Ended December 31, 2019	2018
	(In Millions)	
Federal income tax expense (benefit) on operating earnings	$ 6	$ (165)
Foreign income tax expense on operating earnings	2	1
Total federal and foreign income tax expense before impact of change in enacted legislation	8	(164)
Impact of change in enacted tax legislation on operating earnings	-	5
Total federal and foreign income tax expense (benefit) on operating earnings	8	(159)
Federal income tax expense (benefit) on net realized capital gains (losses)	118	(43)
Total federal and foreign income tax expense (benefit)	$ 126	$ (202)

The tax effects of temporary differences that give rise to significant portions of the DTAs and DTLs are as follows:

	December 31, 2019	December 31, 2018	Change
	(In Millions)		
DTAs:			
Ordinary			
Reserve items	$ 1,262	$ 1,169	$ 93
Policy acquisition costs	602	534	68
Nonadmitted assets	311	349	(38)
Policyholders' dividends	192	196	(4)
Pension and compensation related items	204	185	19
Investment items	149	147	2
Expense items	61	54	7
Unrealized investment losses	20	26	(6)
Other	98	97	-
Total ordinary DTAs	2,899	2,757	142
Nonadmitted DTAs	(26)	(63)	37
Admitted ordinary DTAs	2,873	2,694	179
Capital			
Unrealized investment losses	126	196	(70)
Investment items	30	169	(139)
Total capital DTAs	156	365	(209)
Nonadmitted DTAs	(20)	(11)	(9)
Admitted capital DTAs	136	354	(218)
Admitted DTAs	3,009	3,048	(39)
DTLs:			
Ordinary			
Reserve items	428	499	(71)
Unrealized investment gains	-	416	(416)
Deferred and uncollected premium	242	229	13
Pension items	182	214	(32)
Investment items	135	3	132
Other	243	204	39
Total ordinary DTLs	1,230	1,565	(335)
Capital			
Unrealized investment gains	639	475	164
Investment items	-	2	(2)
Total capital DTLs	639	477	162
Total DTLs	1,869	2,042	(173)
Net admitted DTA	$ 1,140	$ 1,006	$ 134

The change in net deferred income taxes comprised the following:

	Years Ended December 31, 2019	2018
	(In Millions)	
Net DTA(L)	$ 105	$ 213
Less: Items not recorded in the change in net deferred income taxes:		
Tax-effect of unrealized losses	(180)	67
Change in net deferred income taxes	$ (75)	$ 280

As of December 31, 2019, the Company had no net operating or capital loss carryforwards to include in deferred income taxes. The Company has no tax credit carryforwards included in deferred taxes.

The components of federal and foreign income tax are recorded in the Consolidated Statutory Statements of Operations and the Consolidated Statutory Statements of Changes in Surplus and are different from those which would be obtained by applying the prevailing federal income tax rate to net gain from operations before federal income taxes. The significant items causing this difference are as follows:

	Years Ended December 31, 2019	2018
	(In Millions)	
Provision computed at statutory rate of 21%	$ 374	$ (284)
Investment items	(187)	(31)
Nonadmitted assets	39	(55)
Tax credits	(48)	(48)
Change in reserve valuation basis	(23)	(9)
Expense items	5	2
Other	41	(57)
Total statutory income tax expense (benefit)	$ 201	$ (482)
Federal and foreign income tax expense (benefit)	$ 126	$ (202)
Change in net deferred income taxes	75	(280)
Total statutory income tax expense (benefit)	$ 201	$ (482)

The Company received refunds of federal income taxes of $535 million in 2019 and $128 million in 2018.

The total income taxes available in the current and prior years that will be available for recoupment in the event of future net capital losses totaled $57 million related to December 31, 2019, $88 million related to 2018 and $64 million related to 2017.

MassMutual and its eligible U.S. subsidiaries are included in a consolidated U.S. federal income tax return. MassMutual and its eligible U.S. subsidiaries also file income tax returns in various states and foreign jurisdictions. MassMutual and its eligible U.S. subsidiaries and certain affiliates (the Parties) have executed and are subject to a written tax allocation agreement (the Tax Agreement). The Tax Agreement sets forth the manner in which the total combined federal income tax is allocated among the Parties. The Tax Agreement provides MassMutual with the enforceable right to recoup federal income taxes paid in prior years in the event of future net capital losses, which it may incur. Further, the Tax Agreement provides MassMutual with the enforceable right to utilize its net losses carried forward as an offset to future net income subject to federal income taxes.

Companies are generally required to disclose unrecognized tax benefits, which are the tax effect of positions taken on their tax returns that may be challenged by various taxing authorities, in order to provide users of financial statements more information regarding potential liabilities. The Company recognizes tax benefits and related reserves in accordance with existing statutory accounting practices for liabilities, contingencies and impairments of assets.

The following is a reconciliation of the beginning and ending liability for unrecognized tax benefits (in millions):

Balance, January 1, 2019	$	142
Gross change related to positions taken in prior years		(1)
Gross change related to positions taken in current year		12
Gross change related to settlements		-
Gross change related to lapse of statutes of limitations		-
Balance, December 31, 2019	$	153

Included in the liability for unrecognized tax benefits as of December 31, 2019, are $145 million of tax positions for which the ultimate deductibility is highly certain but for which there is uncertainty about the timing of such deductibility. The liability for the unrecognized tax benefits as of December 31, 2019 includes $5 million of unrecognized tax benefits that, if recognized, would impact the Company's effective tax rate.

The Company recognized a decrease of less than $1 million in accrued interest related to the liability for unrecognized tax benefits as a component of the provision for income taxes. The amount of net interest recognized was $15 million as of December 31, 2019 and $15 million as of December 31, 2018. The Company has no accrued penalties related to the liability for unrecognized tax benefits. In the next year, the Company does not anticipate the total amount of uncertain tax positions to significantly increase or decrease.

The Internal Revenue Service (IRS) has completed its examination of MassMutual and its subsidiaries for the years 2013 and prior. The IRS commenced its exam of years 2014-2016 in September 2017. The adjustments resulting from these examinations are not expected to materially affect the position or liquidity of the Company.

As of December 31, 2019 and 2018, the Company did not recognize any protective deposits as admitted assets.

7. Other than invested assets

a. Corporate-owned life insurance

MassMutual holds corporate-owned life insurance issued by unaffiliated third party insurers to cover the lives of certain qualified senior employees. The primary purpose of the program is to offset future employee benefit expenses. MassMutual pays all premiums and is the owner and beneficiary of these policies. MassMutual had recorded cash surrender values of these policies of $2,290 million as of December 31, 2019 and $2,115 million as of December 31, 2018. The cash surrender value is allocated 32% bonds, 26% other invested assets, 21% cash and short-term investments, 19% stocks and 2% real estate as of December 31, 2019 and 34% other invested assets, 28% bonds, 19% cash and short-term investments, 17% stocks and 2% real estate as of December 31, 2018.

b. Deferred and uncollected life insurance premium

Deferred and uncollected life insurance premium, net of loading and reinsurance, are included in other than invested assets in the Company's Consolidated Statutory Statements of Financial Position. The following summarizes the deferred and uncollected life insurance premium on a gross basis, as well as, net of loading and reinsurance:

	December 31,			
	2019		2018	
	Gross	Net	Gross	Net
	(In Millions)			
Ordinary new business	$ 152	$ 44	$ 151	$ 48
Ordinary renewal	851	938	793	863
Group life	8	8	11	11
Total	$ 1,011	$ 990	$ 955	$ 922

Deferred premium is the portion of the annual premium not earned at the reporting date. Loading on deferred premium is an amount obtained by subtracting the valuation net deferred premium from the gross deferred premium and generally includes allowances for acquisition costs and other expenses.

Uncollected premium is gross premium net of reinsurance that is due and unpaid as of the reporting date, net of loading. Net premium is the amount used in the calculation of reserves. The change in deferred and uncollected life insurance premium is included in premium income. The change in loading is included as an expense and is not shown as a reduction to premium income.

Ordinary new business and ordinary renewal business consist of the basic amount of premium required on the underlying life insurance policies.

In certain instances, gross premium is less than net premium according to the standard valuation set by the Division and the Department. The gross premium is less than the net premium needed to establish the reserves because the statutory reserves must use standard conservative valuation mortality tables, while the gross premium calculated in pricing uses mortality tables that reflect both the Company's experience and the transfer of mortality risk to reinsurers. The Company had life insurance in force of $46,608 million as of December 31, 2019 and $34,323 million as of December 31, 2018 for which gross premium was less than net premium.

8. *Policyholders' liabilities*

a. Policyholders' reserves

The Company had life insurance in force of $765,241 million as of December 31, 2019 and $710,989 million as of December 31, 2018.

The following summarizes policyholders' reserves, net of reinsurance, and the range of interest rates by type of product:

	December 31,			
	2019		2018	
	Amount	Interest Rates	Amount	Interest Rates
	($ In Millions)			
Individual life	$ 61,109	2.5 % - 6.0 %	$ 55,082	2.5 % - 6.0 %
Group annuities	28,101	2.3 % - 11.8 %	26,382	2.3 % - 11.3 %
Individual universal and variable life	19,689	3.0 % - 6.0 %	7,366	3.5 % - 6.0 %
Individual annuities	17,172	1.9 % - 11.3 %	16,675	2.3 % - 11.8 %
Group life	5,023	2.5 % - 4.5 %	17,290	2.5 % - 4.5 %
Disabled life claim reserves	1,825	3.5 % - 6.0 %	1,847	3.5 % - 6.0 %
Disability active life reserves	1,249	3.5 % - 6.0 %	1,121	3.5 % - 6.0 %
Other	396	2.5 % - 6.0 %	336	2.5 % - 6.0 %
Total	$ 134,564		$ 126,099	

Individual life includes whole life and term insurance. Group life includes corporate-owned life insurance, bank-owned life insurance, group universal life and group variable universal life products. Individual annuities include individual annuity contracts, supplementary contracts involving life contingencies and structured settlements. Group annuities include deferred annuities and single premium annuity contracts. Disabled life claim reserves include disability income and LTC contracts and cover the future payments of known claims. Disability active life reserves include disability income and LTC contracts issued. Other is comprised of disability life and accidental death insurance. In 2019, certain corporate-owned life insurance and bank owned-life insurance policies were reclassified to individual as they did not meet the group classification qualifications.

b. Liabilities for deposit-type contracts

The following summarizes liabilities for deposit-type contracts and the range of interest rates by type of product:

	December 31,			
	2019		2018	
	Amount	Interest Rates	Amount	Interest Rates
	($ In Millions)			
Guaranteed interest contracts:				
Note programs	$ 6,936	1.4 % - 5.6 %	$ 5,987	1.6 % - 6.2 %
Federal Home Loan Bank of Boston	1,104	2.1 % - 3.4 %	1,104	1.4 % - 3.4 %
Municipal contracts	766	1.3 % - 7.3 %	815	1.3 % - 7.3 %
Other	1,010	1.5 % - 3.4 %	919	1.2 % - 3.7 %
Supplementary contracts	2,745	0.3 % - 6.8 %	2,582	0.3 % - 6.8 %
Dividend accumulations	493	3.0 % - 3.5 %	509	3.0 % - 3.6 %
Other deposits	2,345	4.0 % - 8.0 %	2,559	4.0 % - 8.0 %
Total	$ 15,399		$ 14,475	

Note programs

Funding agreements are investment contracts sold to domestic and international institutional investors. Funding agreement liabilities are equal to the account value and are established by contract deposits, increased by interest credited and decreased by contract coupon payments and maturities. Contract holders do not have the right to terminate the contract prior to the contractually stated maturity date. The Company may retire funding agreements prior to the contractually-stated maturity date by repurchasing the agreement in the market or, in some cases, by calling the agreement. If this occurs, the difference in value is an adjustment to interest credited to liabilities for deposit-type contracts in the Consolidated Statutory Statements of Operations. Credited interest rates vary by contract and can be fixed or floating. Agreements do not have put provisions or ratings-based triggers. The liability of non-U.S. dollar denominated funding agreements may increase or decrease due to changes in foreign exchange rates. Currency swaps are employed to eliminate foreign exchange risk from all funding agreements issued to back non-U.S. dollar denominated notes.

Under the note programs, MassMutual creates special purpose entities (SPEs), which are investment vehicles or trusts, for the purpose of issuing medium-term notes to investors. Proceeds from the sale of the medium-term notes issued by these SPEs are used to purchase funding agreements from MassMutual. The payment terms of any particular series of notes are matched by the payment terms of the funding agreement securing the series. Notes are currently issued from MassMutual's $21.0 billion Global Medium-Term Note Program.

Federal Home Loan Bank of Boston

MassMutual has funding agreements with Federal Home Loan Bank of Boston (FHLB Boston) in an investment spread strategy, consistent with its other funding agreements. These funding agreements are collateralized by securities with estimated fair values of $1,137 million as of December 31, 2019. MassMutual's borrowing capacity with FHLB Boston is subject to the lower of the limitation on the pledge of collateral for a loan set forth by law or by MassMutual's internal limit. MassMutual's unused capacity was $896 million as of December 31, 2019. As a member of FHLB Boston, MassMutual held common stock of FHLB Boston with a statement value of $59 million as of December 31, 2019 and $74 million as of December 31, 2018.

Municipal contracts

Municipal guaranteed investment contracts (municipal contracts) include contracts that contain terms with above market crediting rates. Liabilities for these contracts includes the municipal contracts' account values, which are established by contract deposits, increased by interest credited (fixed or floating) and decreased by contract coupon payments, additional withdrawals, maturities and amortization of premium. Certain municipal contracts allow additional deposits, subject to restrictions, which are credited based on the rates in the contracts. Contracts have scheduled payment dates and amounts and interest is paid periodically. In addition, certain contracts allow additional withdrawals above and beyond the scheduled payments. These additional withdrawals have certain restrictions on the number per year, minimum dollar amount and are limited to the maximum contract balance. The majority of the municipal contracts allow early contract termination under certain conditions.

Certain municipal contracts contain make-whole provisions, which document the formula for full contract payout. Certain municipal contracts have ratings-based triggers that allow the trustee to declare the entire balance due and payable. Municipal contracts may also have terms that require the Company to post collateral to a third party based on the contract balance in the event of a downgrade in ratings below certain levels under certain circumstances. When the collateral is other than cash, the collateral value is required to be greater than the account balance. The collateral was $148 million as of December 31, 2019 and $158 million as of December 31, 2018. The Company employs a rigorous asset/liability management process to help mitigate the economic impacts of various liability risks. By performing asset liability management and performing other risk management activities, the Company believes that these contract provisions do not create an undue level of operating risk to the Company.

Other deposits

Other deposits primarily consist of investment contracts assumed as part of the indemnity reinsurance agreement discussed in *Note 9. "Reinsurance"*. These contracts are used to fund retirement plans. Contract payments are not contingent upon the life of the retirement plan participant.

As of December 31, 2019, the Company's guaranteed interest contracts by expected maturity year were as follows (in millions):

2020	$	1,408
2021		1,588
2022		1,629
2023		163
2024		1,046
Thereafter		3,982
Total	$	9,816

Most guaranteed interest contracts only mature on their contractual maturity date. Actual maturities for municipal contracts may differ from their contractual maturity dates, as these contracts permit early contract termination under certain conditions.

c. Unpaid claims and claim expense reserves

The Company establishes unpaid claims and claim expense reserves to provide for the estimated costs of claims for individual disability and LTC policies. These reserves include estimates for both claims that have been reported and those that have been incurred but not reported, and include estimates of all future expenses associated with the processing and settling of these claims. This estimation process is primarily based on the assumption that experience is an appropriate indicator of future events and involves a variety of actuarial techniques that analyze experience, trends and other relevant factors. The amounts recorded for unpaid claims and claim expense reserves represent the Company's best estimate based upon facts and actuarial guidelines. Accordingly, actual claim payouts may vary from these estimates.

The following summarizes the changes in disabled life and LTC unpaid claims and claim expense reserves:

	December 31, 2019	December 31, 2018
	(In Millions)	
Claim reserves, beginning of year	$ 2,102	$ 2,069
Less: Reinsurance recoverables	228	192
Net claim reserves, beginning of year	1,874	1,877
Claims paid related to:		
Current year	(13)	(13)
Prior years	(339)	(334)
Total claims paid	(352)	(347)
Incurred related to:		
Current year's incurred	240	241
Current year's interest	3	3
Prior year's incurred	11	22
Prior year's interest	77	78
Total incurred	331	344
Net claim reserves, end of year	1,853	1,874
Reinsurance recoverables	242	228
Claim reserves, end of year	$ 2,095	$ 2,102

The changes in reserves for incurred claims related to prior years are generally the result of recent loss development trends. The $11 million increase in the prior years' incurred claims for 2019 and the $22 million increase in the prior years' incurred claims for 2018 were generally the result of differences between actual termination experience and statutorily prescribed termination tables. In 2019, claim experience included normal claim volume with higher terminations, resulting in a reduction to the incurred reserve from favorable experience, while 2018 claims incurred was due to maturing LTC business partially offset by a corresponding increase in reinsurance recoverable.

The following reconciles disabled life claim reserves to the net claim reserves at the end of the years presented in the previous table. Disabled life claim reserves are recorded in policyholders' reserves. Accrued claim liabilities are recorded in other liabilities.

	December 31, 2019	December 31, 2018
	(In Millions)	
Disabled life claim reserves	$ 1,825	$ 1,847
Accrued claim liabilities	28	27
Net claim reserves, end of year	$ 1,853	$ 1,874

d. Additional liability for annuity contracts

Certain individual variable annuity and fixed index annuity products have additional death or other insurance benefit features, such as GMDBs, GMIBs, GMABs and GMWBs. In general, living benefit guarantees require the contract holder or policyholder to adhere to a company approved asset-allocation strategy. Election of these benefit guarantees is generally only available at contract issue.

The following shows the changes in the liabilities for GMDB, GMIB, GMAB and GMWB (in millions):

Liability as of January 1, 2018	$ 515
Incurred guarantee benefits	252
Paid guarantee benefits	(7)
Liability as of December 31, 2018	760
Incurred guarantee benefits	(163)
Paid guarantee benefits	(9)
Liability as of December 31, 2019	$ 588

The Company held reserves in accordance with the stochastic and standard scenarios as of December 31, 2019 and December 31, 2018. As of December 31, 2019 and December 31, 2018, the Company held additional reserves above those indicated based on the stochastic scenarios in order to maintain a prudent level of reserve adequacy.

The following summarizes the account values, net amount at risk and weighted average attained age for variable annuity contracts with GMDB, GMIB, GMAB and GMWB classified as policyholders' reserves and separate account liabilities. The net amount at risk is defined as the minimum guarantee less the account value calculated on a policy-by-policy basis, but not less than zero.

	December 31, 2019			December 31, 2018		
	Account Value	Net Amount at Risk	Weighted Average Attained Age	Account Value	Net Amount at Risk	Weighted Average Attained Age
	($ In Millions)					
GMDB	$ 19,980	$ 63	65	$ 18,919	$ 175	64
GMIB Basic	718	28	69	700	97	69
GMIB Plus	2,906	532	68	2,687	813	67
GMAB	2,544	2	60	2,573	74	60
GMWB	151	10	71	160	23	70

As of December 31, 2019, the GMDB account value above consists of $4,088 million of Modco assumed within the separate accounts. As of December 31, 2018, the GMDB account value above consists of $3,838 million of Modco assumed within the separate accounts.

Account values of variable annuity contracts with GMDB, GMIB, GMAB and GMWB are summarized below:

	December 31,					
	2019			2018		
	Separate Account	General Account	Total	Separate Account	General Account	Total
	(In Millions)					
GMDB	$ 15,859	$ 4,121	$ 19,980	$ 14,641	$ 4,278	$ 18,919
GMIB Basic	700	18	718	683	17	700
GMIB Plus	2,906	-	2,906	2,687	-	2,687
GMAB	2,504	40	2,544	2,534	39	2,573
GMWB	151	-	151	160	-	160

e. Additional liability for individual life contracts

Certain universal life and variable universal life contracts include features such as GMDBs or other guarantees that ensure continued death benefit coverage when the policy would otherwise lapse. The value of the guarantee is only available to the beneficiary in the form of a death benefit.

The following presents the changes in the liability, net of reinsurance, for guarantees on universal life and variable universal life type contracts:

	December 31, 2019	December 31, 2018
	(In Millions)	
Beginning balance	$ 3,967	$ 3,621
Net liability (decrease) increase	(86)	346
Ending balance	$ 3,881	$ 3,967

9. Reinsurance

The Company enters into reinsurance agreements with affiliated and unaffiliated insurers in the normal course of business in order to mitigate the impact of underwriting mortality and morbidity risks or to assume business. Such transfers do not relieve the Company of its primary liability to its customers and, as such, failure of reinsurers to honor their obligations could result in credit losses that could arise if a reinsurer defaults. The Company reduces reinsurance default risk by evaluating the financial condition of reinsurers and monitoring for possible concentrations within the Company's reinsurers and using trust structures, when appropriate. The Company reinsures a portion of its mortality risk in its life business under either a first dollar quota-share arrangement or an in excess of the retention limit arrangement with reinsurers. The Company also reinsures a portion of its morbidity risk in its disability and LTC business. The amounts reinsured are on a yearly renewable term, coinsurance funds withheld, coinsurance or Modco basis. The Company's highest retention limit for new issues of life policies ranges from $15 million to $25 million.

The Company did not reinsure any policies with a company chartered in a country other than the U.S., excluding U.S. branches of these companies, which was owned in excess of 10% or controlled directly or indirectly by an insured, a beneficiary, a creditor or any other person not primarily engaged in the insurance business. There are no reinsurance agreements in effect under which the reinsurer may unilaterally cancel any reinsurance for reasons other than for nonpayment of premium or other similar credits. The Company has no reinsurance agreements in effect such that the amount of losses paid or accrued through the statement date may result in a payment to the reinsurer of amounts which, in aggregate and allowing for offset of mutual credits from other reinsurance agreements with the same reinsurer, exceed the total direct premium collected under the reinsured policies.

If all reinsurance agreements were terminated by either party as of December 31, 2019, the resulting reduction in surplus due to loss of reinsurance reserve credits, net of unearned premium, would be approximately $6,073 million assuming no return of the assets, excluding assets in trust, backing these reserves from the reinsurer to the Company.

Reinsurance amounts included in the Consolidated Statutory Statements of Operations were as follows:

	Years Ended December 31, 2019	Years Ended December 31, 2018
	(In Millions)	
Direct premium	$ 27,016	$ 24,913
Premium assumed	1,423	1,281
Premium ceded	(5,340)	(2,932)
Total net premium	$ 23,099	$ 23,262
Ceded reinsurance recoveries	$ 952	$ 907
Assumed losses	$ 81	$ 79

Reinsurance amounts included in the Consolidated Statutory Statements of Financial Position were as follows:

	December 31, 2019	December 31, 2018
	(In Millions)	
Reinsurance reserves		
Assumed	$ 7,999	$ 8,070
Ceded	(18,416)	(12,708)
Ceded amounts recoverable	$ 262	$ 242
Benefits payable on assumed business	$ 7	$ 1
Funds held under coinsurance		
Ceded	$ 4,252	$ 4,099

Reinsurance reserves ceded to unaffiliated reinsurers as of December 31, 2019 include $8,805 million associated with life insurance policies, $3,598 million for LTC, $5,982 million for annuity, $23 million for disability and $8 million for group life and health. Reinsurance reserves ceded to unaffiliated reinsurers as of December 31, 2018 include $8,410 million associated with life insurance policies, $2,266 million for LTC, $1,996 million for annuity, $27 million for disability and $9 million for group life and health.

In 2019, the Company increased its gross LTC policyholders' reserves by $1,224 million through a combination of prior year error corrections of $729 million and various assumption changes to reflect the risk inherent in the cash flows of this business. This risk is ceded to an unaffiliated reinsurer, therefore the ceded policyholders' reserves have also been increased by an additional $1,224 million.

In 2018, the Company increased its gross LTC policyholders' reserves by $390 million to reflect the risk inherent in the cash flows of this business. This risk is ceded to an unaffiliated reinsurer, therefore the ceded policyholders' reserves have also been increased by $390 million.

In 2018, a $41 million net loss was recorded for the recapture of certain yearly renewable term life insurance treaties, with $20 million recorded in premium income and $61 million recorded in change in policyholder reserves.

As of December 31, 2019, one reinsurer accounted for 30% of the outstanding balance of the reinsurance recoverable and the next largest reinsurer had 21%. The Company continues to monitor its morbidity risk ceded to one unaffiliated reinsurer for its LTC business, in which 27% of the reserves are held in trust.

10. Withdrawal characteristics

a. Annuity actuarial reserves and liabilities for deposit-type contracts

The withdrawal characteristics of the Company's annuity actuarial reserves and deposit-type contracts as of December 31, 2019 are illustrated below:

Individual annuities

	General Account	Separate Account with Guarantees	Separate Account Non-Guaranteed	Total	% of Total
	(In Millions)				
Subject to discretionary withdrawal:					
With market value adjustment	$ 44	$ -	$ -	$ 44	- %
At book value less current surrender charge of 5% or more	9,459	-	-	9,459	27
At fair value	-	-	12,408	12,408	36
Total with market value adjustment or at fair value	9,503	-	12,408	21,911	63
At book value without adjustment (minimal or no charge or adjustment)	6,559	-	-	6,559	19
Not subject to discretionary withdrawal	6,195	-	-	6,195	18
Total	$ 22,257	$ -	$ 12,408	$ 34,665	100 %
Reinsurance ceded	5,085	-	-	5,085	
Total, net of reinsurance	$ 17,172	$ -	$ 12,408	$ 29,580	
Amount included in book value moving to at book value without adjustment after statement date	127	-	-	127	

Group annuities

	General Account	Separate Account with Guarantees	Separate Account Non-Guaranteed	Total	% of Total
	(In Millions)				
Subject to discretionary withdrawal:					
With market value adjustment	$ 12,438	$ -	$ -	$ 12,438	17 %
At book value less current surrender charge of 5% or more	1	-	-	1	-
At fair value	-	15,577	28,487	44,064	60
Total with market value adjustment or at fair value	12,439	15,577	28,487	56,503	77
At book value without adjustment (minimal or no charge or adjustment)	2,608	556	-	3,164	4
Not subject to discretionary withdrawal	13,951	-	-	13,951	19
Total	$ 28,998	$ 16,133	$ 28,487	$ 73,618	100 %
Reinsurance ceded	897	-	-	897	
Total, net of reinsurance	$ 28,101	$ 16,133	$ 28,487	$ 72,721	

Deposit-type contracts

	General Account	Separate Account with Guarantees	Separate Account Non-Guaranteed	Total	% of Total
	(In Millions)				
Subject to discretionary withdrawal:					
With market value adjustment	$ 2,357	$ -	$ -	$ 2,357	9 %
At fair value	-	1,558	9,312	10,870	41
Total with market value adjustment or at fair value	2,357	1,558	9,312	13,227	50
At book value without adjustment (minimal or no charge or adjustment)	2,929	-	-	2,929	11
Not subject to discretionary withdrawal	10,113	-	-	10,113	39
Total	$ 15,399	$ 1,558	$ 9,312	$ 26,269	100 %

The following is a summary of total annuity actuarial reserves and liabilities for deposit-type contracts as of December 31, 2019 (in millions):

Consolidated Statutory Statements of Financial Position:	
Policyholders’ reserves – group annuities	$ 28,101
Policyholders’ reserves – individual annuities	17,172
Liabilities for deposit-type contracts	15,399
Subtotal	60,672
Separate Account Annual Statement:	
Annuities	57,028
Other annuity contract deposit-funds and guaranteed interest contracts	10,870
Subtotal	67,898
Total	$ 128,570

b. Analysis of Life Actuarial Reserves by Withdrawal Characteristics

The withdrawal characteristics of the Company's life actuarial reserves as of December 31, 2019 are illustrated below:

	General account			Separate account - nonguaranteed		
	Account Value	Cash Value	Reserve	Account Value	Cash Value	Reserve
Subject to discretionary withdrawal, surrender values, or policy loans						
Universal life	16,732	16,717	16,792	-	-	-
Universal life with secondary guarantees	3,008	2,642	7,760	-	-	-
Other permanent cash value life insurance	66	63,307	66,043	-	-	-
Variable life	3	3	1	9	9	13
Variable universal life	617	607	672	8,007	7,935	8,003
Not subject to discretionary withdrawal or no cash values						
Term policies without cash value	-	-	2,551	-	-	-
Accidental death benefits	-	-	3	-	-	-
Disability - active lives	-	-	142	-	-	-
Disability - disabled lives	-	-	303	-	-	-
Miscellaneous reserves	-	-	1,490	-	-	-
Total (gross: direct + assumed)	20,426	83,276	95,757	8,016	7,944	8,016
Reinsurance Ceded	4,966	5,070	9,540	-	-	-
Total (net)	15,460	78,206	86,217	8,016	7,944	8,016

c. Separate accounts

The Company has guaranteed separate accounts classified as the following: nonindexed, which have multiple concurrent guarantees, including a guarantee that applies for as long as the contract is in effect and does not exceed a 4% rate of return. The Company has nonguaranteed separate accounts which are variable accounts where the benefit is determined by the performance and/or market value of the investments held in the separate account with incidental risk, notional expense and minimum death benefit guarantees.

Information regarding the separate accounts of the Company as of and for the year ended December 31, 2019 is as follows:

	Guaranteed			
	Indexed	Nonindexed Less than/ Equal to 4%	Non Guaranteed	Total
	(In Millions)			
Net premium, considerations or deposits for the year ended December 31, 2019	$ -	$ -	$ 7,496	$ 7,496
Reserves at December 31, 2019:				
For accounts with assets at:				
Fair value	$ -	$ 17,691	$ 53,181	$ 70,872
Amortized cost/book value	-	5,042	-	5,042
Subtotal SIA Reserves	-	22,733	53,181	75,914
Nonpolicy liabilities	-	1	744	745
Total Separate Account Liabilities	$ -	$ 22,734	$ 53,925	$ 76,659
Reserves by withdrawal characteristics:				
Subject to discretionary withdrawal:				
At fair value	$ -	$ 17,135	$ 53,181	$ 70,316
At book value without market value adjustment and current surrender charge of less than 5%	-	5,598	-	5,598
Subtotal	-	22,733	53,181	75,914
Not subject to discretionary withdrawal	-	-	-	-
Nonpolicy liabilities	-	1	744	745
Total Separate Account Liabilities	$ -	$ 22,734	$ 53,925	$ 76,659

As of December 31, 2019, the Company has $5 million of AVR related to book value separate accounts.

The following is a reconciliation of amounts reported as transfers (from) to separate accounts in the Summary of Operations of the Company's NAIC Separate Account Annual Statement to the amounts reported as net transfers (from) to separate accounts in change in policyholders' reserves in the accompanying Consolidated Statutory Statements of Operations:

	Years Ended December 31, 2019	2018
	(In Millions)	
From the Separate Account Annual Statement:		
Transfers to separate accounts	$ 7,333	$ 8,409
Transfers from separate accounts	(12,597)	(10,123)
Subtotal	(5,264)	(1,714)
Reconciling adjustments:		
Net deposits on deposit-type liabilities	(967)	(1,488)
Net transfers from separate accounts	$ (6,231)	$ (3,202)

Net deposits on deposit-type liabilities are not considered premium and therefore are excluded from the Consolidated Statutory Statements of Operations.

11. Debt

MassMutual issues commercial paper in the form of Notes in minimum denominations of $250 thousand up to a total aggregation of $1,000 million with maturity dates up to a maximum of 270 days from the date of issuance. Noninterest bearing Notes are sold at par less a discount representing an interest factor. Interest bearing Notes are sold at par. The Notes are not redeemable or subject to voluntary prepayments by MassMutual. The Notes had a carrying value and face amount of $250 million as of December 31, 2019 and $250 million as of 2018. Notes issued in 2019 had interest rates ranging from 1.68% to 2.60% with maturity dates ranging from 21 to 40 days. Interest expense for commercial paper was $6 million for the year ended December 31, 2019 and $5 million for the year ended December 31, 2018.

MassMutual has a $1,000 million, five-year credit facility, with a syndicate of lenders that can be used for general corporate purposes and to support commercial paper borrowings. During December 2018, the facility was renewed and the scheduled maturity is December 2023. The facility includes two one-year extension options that may be exercised with proper notification as set forth in the agreement. The facility has an upsize option for an additional $500 million. The terms of the credit facility additionally provide for, among other provisions, covenants pertaining to liens, fundamental changes, transactions with affiliates and adjusted statutory surplus. As of and for the years ended December 31, 2019 and 2018, MassMutual was in compliance with all covenants under the credit facility. For the years ended December 31, 2019 and 2018, there were no draws on the credit facilities. Credit facility fees were less than $1 million for the years ended December 31, 2019 and December 31, 2018.

12. Employee benefit plans

The Company sponsors multiple employee benefit plans, providing retirement, life, health and other benefits to employees, certain employees of unconsolidated subsidiaries, agents, general agents and retirees who meet plan eligibility requirements.

a. Pension plans

The Company has funded and unfunded noncontributory defined benefit pension plans that cover substantially all employees, agents and retirees. The qualified defined benefit plan includes a defined benefit formula and a cash balance formula. Participants earn benefits under the plan based on the defined benefit formula, the cash balance formula, or a combination of both formulas as determined by their date of hire or rehire. Under the defined benefit formula, benefits are calculated based on final average earnings and length of service. Benefits under the cash balance formula are determined based on age, service and salary during the participants' careers.

The Company's policy is to fund qualified pension costs in accordance with the Employee Retirement Income Security Act of 1974. The Company did not contribute to its qualified benefit plan in 2019. The Company contributed $188 million in 2018.

b. Defined contribution plans

The Company sponsors funded (qualified 401(k) thrift savings) and unfunded (nonqualified deferred compensation thrift savings) defined contribution plans for its employees, agents and retirees. The qualified 401(k) thrift savings plan's net assets available for benefits were $3,385 million as of December 31, 2019 and $2,831 million as of December 31, 2018. The Company match for the qualified 401(k) thrift savings plan is limited to 5% of eligible W-2 compensation. The Company's total matching thrift savings contributions included in general insurance expenses were $54 million for the year ended December 31, 2019 and $51 million for the year ended December 31, 2018.

The Company also maintains a defined contribution plan for agents, which was frozen in 2001. The net assets available for these benefits were $174 million as of December 31, 2019 and $164 million as of December 31, 2018.

c. Other postretirement benefits

The Company provides certain life insurance and health care benefits (other postretirement benefits) for its retired employees and agents, their beneficiaries and covered dependents. MMHLLC has the obligation to pay the Company's other postretirement benefits. The transfer of this obligation to MMHLLC does not relieve the Company of its primary liability. MMHLLC is allocated other postretirement expenses related to interest cost, amortization of actuarial gains (losses) and expected return on plan assets, whereas service cost and prior service cost are recorded by the Company.

Substantially all of the Company's U.S. employees and agents may become eligible to receive other postretirement benefits. These benefits are funded as the benefits are provided to the participants. For employees who retire after 2009, except certain employees who were close to retirement in 2010, the Company's cost is limited to a retiree health reimbursement account "RHRA" which accumulates during an employee's career and can be drawn down by the retiree to purchase coverage outside of the Company or for other health care costs. Retired employees with a RHRA also may choose to purchase coverage through the private retiree exchange.

For other current and future retired employees, and current and future retired agents, the Company provides access to postretirement health care plans through a private retiree exchange. The Company's cost is limited to the fixed annual subsidy provided to retirees through a Health Reimbursement Account each year that the retiree can use to purchase coverage on the exchange or for other health care costs.

Company-paid basic life insurance is provided to retirees who retired before 2010 and certain employees who retire after 2009 but were close to retirement in 2010. Supplemental life insurance is available to certain retirees on a retiree-pay-all basis.

The Company provides retiree life insurance coverage for home office employees who, as of January 1, 2010, were age 50 with at least 10 years of service or had attained 75 points, generally age plus service, with a minimum 10 years of service.

d. Benefit obligations

Accumulated benefit obligations are the present value of pension benefits earned as of a December 31 measurement date (the Measurement Date) based on service and compensation and do not take into consideration future salary levels.

Projected benefit obligations for pension benefits are the present value of pension benefits earned as of the Measurement Date projected for estimated salary increases to an assumed date with respect to retirement, termination, disability or death.

Refer to *Note 12f. "Amounts recognized in the Consolidated Statutory Statements of Financial Position,"* for details on the funded status of the plans. Accumulated and projected postretirement benefit obligations for other postretirement benefits are the present value of postretirement medical and life insurance benefits earned as of the Measurement Date projected for estimated salary and medical claim rate increases to an assumed date with respect to retirement, disability or death.

Actuarial (gains) losses represent the difference between the expected results and the actual results used to determine the projected benefit obligation, accumulated benefit obligation and current year expense. Select assumptions used in this calculation include expected future compensation levels, healthcare cost trends, mortality and expected retirement age.

The following presents the total pension and other postretirement accumulated benefit obligation:

	December 31, 2019	December 31, 2018	December 31, 2019	December 31, 2018
	Pension Benefits		Other Postretirement Benefits	
	(In Millions)			
Accumulated benefit obligation	$ 3,270	$ 2,739	$ 383	$ 341

The following sets forth the change in projected benefit obligation of the defined benefit pension and other postretirement plans:

	December 31, 2019	December 31, 2018	December 31, 2019	December 31, 2018
	Pension Benefits		Other Postretirement Benefits	
	(In Millions)			
Projected benefit obligation, beginning of year	$ 2,850	$ 3,036	$ 341	$ 354
Service cost	111	113	13	14
Interest cost	118	107	13	12
Actuarial (gains) losses	11	(39)	(9)	-
Benefits paid	(139)	(142)	(15)	(14)
Change in discount rate	431	(218)	34	(21)
Change in actuarial assumptions	(112)	(7)	6	(4)
Projected benefit obligation, end of year	$ 3,270	$ 2,850	$ 383	$ 341

The determination of the discount rate is based upon rates commensurate with current yields on high quality corporate bonds as of the Measurement Date. A spot yield curve is developed from this data that is used to determine the present value for the obligation. The projected plan cash flows are discounted to the Measurement Date based on the spot yield curve. A single discount rate is utilized to ensure the present value of the benefits cash flow equals the present value computed using the spot yield curve. A 25 basis point change in the discount rate results in approximately a $108 million change in the projected pension benefit obligation. The methodology includes producing a cash flow of annual accrued benefits. Refer to Note *12h. "Assumptions"* for details on the discount rate. The 2019 change in actuarial assumptions consisted primarily of lowering the interest crediting rate assumptions from 6% to 5% (pension benefits only), and adopting the white collar version of the mortality table assumption.

e. Plan assets

The assets of the qualified pension plan are invested through a MassMutual group annuity contract and investments held in a trust. The group annuity contract invests in the General Investment Account (GIA) of the Company and separate investment accounts. The separate investment accounts are managed by the Company, the Company's indirectly wholly owned asset manager, subsidiaries, as well as unaffiliated asset managers.

The Company's qualified pension plan assets managed by the Company and its indirectly wholly owned subsidiaries are as follows:

	December 31, 2019	December 31, 2018
	(In Millions)	
General Investment Account	$ 245	$ 247
Separate Investment Accounts:		
Barings Long Duration Bond Fund	326	289
Invesco Oppenheimer International Growth	-	119
Alternative Investment Separate Account	-	85
Oppenheimer Large Core Fund	-	79
MM Select Large Cap Value Fund	-	55
MM Premier Strategic Emerging Markets Fund	-	46
MM Select Growth Opportunities Fund	-	39
MM Select Blue Chip Growth Fund	-	38
Oppenheimer Small Capitalization Core Fund	-	32
MM Select Small Cap Growth Fund	-	21
MM Select Small Cap Value Fund	-	20
	$ 571	$ 1,070

The approximate amount of annual benefits to be paid to plan participants covered by a group annuity contract issued by the employer or related parties is $122 million for 2020.

The Company employs a total return investment approach whereby a mix of equities and fixed-income investments are used to maximize the long-term return of plan assets with a prudent level of risk. Risk tolerance is established through consideration of plan liabilities, plan funded status and the Company's financial condition. The investment portfolio contains a diversified blend of equity and fixed-income investments. Alternative assets such as private equity funds, hedge funds, private real estate funds, equity index exchange traded funds and bond index exchange traded funds are used to improve portfolio diversification. Investment risk is measured and monitored on an ongoing basis through quarterly investment portfolio reviews, annual liability measurements and periodic asset and liability studies.

The target range allocations for the qualified pension plan assets are 12.5% to 22.5% domestic equity securities, 25% to 45% long duration bond securities, 5% to 15% GIA and aggregate bond assets, 12.5% to 22.5% international equity securities and 10% to 30% alternative investments. Domestic equities primarily include investments in large capitalization (large-cap) companies and small capitalization (small cap) companies. Long duration bond securities invest in several long-duration bond exchange traded funds. International equities include investments in American Depository Receipts and limited partnerships that trade primarily in foreign markets in Europe, Latin America and Asia. The pension plan assets invested in the GIA through the unallocated group annuity contract earn a fixed interest. These assets comprised approximately 9% of the plan assets as of December 31, 2019 and 10% as of December 31, 2018.

The following presents the change in fair value of plan assets:

	December 31, 2019	2018	2019	2018
	Pension Benefits		Other Postretirement Benefits	
	(In Millions)			
Fair value of plan assets, beginning of year	$ 2,403	$ 2,485	$ 4	$ 4
Actual return on plan assets	450	(148)	-	-
Employer contributions	24	208	13	13
Contributions by plan participants	-	-	1	1
Benefits paid	(139)	(142)	(15)	(14)
Fair value of plan assets, end of year	$ 2,738	$ 2,403	$ 3	$ 4

The *General Investment Account* is designed to provide stable, long-term investment growth. The account value is maintained at a stable value (generally referred to as “book value”) regardless of financial market fluctuations; however, if the plan sponsor initiates a full or partial termination, the amount liquidated is subject to an adjustment that could result in an increase or decrease in the book value of the plan's investment.

The following presents the GIA allocation by type of investment:

	December 31, 2019	2018
Bonds	58 %	61 %
Mortgage loans	16	15
Common stocks - subsidiaries and affiliates	10	6
Other investments	9	7
Partnerships and LLCs	5	7
Cash and cash equivalents	2	3
Real estate	-	1
	100 %	100 %

The majority of the assets of the qualified pension plan are invested in the following separate investment account options as well as certain private equity funds, hedge funds, private real estate funds and an all cap U.S. equity index exchange traded fund held in the MassMutual Pension Plan Trust (Pension Trust Assets):

Pacific Investment Management Company Long Duration Bond Fund is a separate investment account advised by Pacific Investment Management Company that invests in a diversified portfolio of fixed-income securities, including short-term, intermediate and long-term credit and government securities and cash. The specific performance objective is to outperform the total return of the Bloomberg Barclays U.S. Long Government/Credit Bond index.

Goldman Sachs Asset Management Long Duration Bond Fund is a separate investment account advised by Goldman Sachs Asset Management that invests in a diversified portfolio of fixed-income securities, including short-term, intermediate and long-term credit, government securities and cash. The specific performance objective is to outperform the total return of the Bloomberg Barclays U.S. Long Government/Credit Bond index.

Barings Long Duration Bond Fund is a separate investment account advised by Barings with a long duration bond strategy that invests in a diversified portfolio of fixed-income securities, including, short-term, intermediate and long-term credit, government securities and cash. The specific performance objective is to outperform the total return of the Bloomberg Barclays U.S. Long Government/Credit Bond index.

Oakmark International Collective Fund is a separate investment account advised by Harris Associates that invests primarily in developed market international large-cap equity securities, which may include common stocks, preferred stocks, securities that are convertible into common stocks, depositary receipts and rights and warrants to buy common stocks. This international equity strategy seeks out companies that it believes to be trading in the market at significant discounts to their underlying values.

Invesco Oppenheimer International Growth Fund is a separate investment account investing in a mutual fund sub-advised by OFI Institutional Asset Management that invests in international large-cap securities, primarily in the developed international markets. This international equity strategy focuses on well-positioned, well-managed businesses that have strong revenue growth, sustainable profit margins, capital efficiency and/or business integrity.

MassMutual Pension Plan Trust is a trust account with a strategy of investing in alternative investments as directed by the Investment Fiduciary Committee. These investments include private equity, hedge funds, and private real estate, with allocations temporarily awaiting investment held in an all cap U.S. equity index exchange traded fund.

Fair Value Measurements

The Company's fair value hierarchy is defined in *Note 4. "Fair value of financial instruments"*.

The following is a description of the valuation methodologies used to measure fair value for the investments in the qualified pension plan.

Separate Investment Accounts: There are two methods of determining unit value for the separate investment accounts. The portfolio method is used when the separate investment account invests in a portfolio of securities or two or more underlying mutual funds, bank collective trust funds or other investment vehicles (each an underlying fund). Under this method, the unit value of a separate investment account is determined by dividing the market value of such separate investment account on any valuation date by the total number of units in the separate investment account. The net investment factor method (NIF) is used when the separate investment account invests in shares or units of a single underlying fund. Under this method, the unit value of a separate investment account is determined by taking the unit value for the prior valuation day and multiplying it by the net investment factor for the current valuation day. Under both of these methods the separate investment accounts are therefore classified as Level 2. As of December 31, 2019, the Plan had no specific plans or intentions to sell investments at amounts other than NAV. These investments can be redeemed on a daily basis and have no lockups or funding commitments.

Corporate debt instruments: If Level 1 valuations are not available, the fair value is determined using models such as matrix pricing and therefore, is classified as Level 2, which uses quoted market prices of debt securities with similar characteristics. Valued using the closing price reported on the active market on which the individual securities are traded.

PIMCO bond funds: Valued using the closing price reported on the active market on which the individual securities are traded and therefore classified as Level 1.

Government securities: Marked to market daily based on values provided by third-party vendors or market makers to the extent available or based on model prices. Valuations furnished by a pricing service take into account factors such as institutional-size trading in similar securities, yield, quality, coupon rate, maturity, type of issue, trading characteristics, and other market data and are therefore classified as Level 2.

Common stocks: Valued using the closing price reported on the active market on which the individual securities are traded and therefore classified as Level 1.

Collective investment trust: Valued using the NAV per unit. The net asset value per unit of the Funds is calculated on each business day by dividing the total value of assets, less liabilities, by the number of units outstanding. Unit issuances and redemptions are based on the net asset value determined at the end of the current day and therefore classified as NAV.

Limited partnerships: The Plan utilizes the practical expedient to calculate fair value of its investments based on the Plan's pro rata interest in net assets of each underlying partnership. All valuations utilize financial information supplied by the partnership, including income, expenses, gains and losses. The underlying investments of the partnership are accounted for at fair value as described in the partnership's audited financial statements. The multi-strategy hedge fund can be redeemed semi-annually with 95 day notice. The remaining funds can be redeemed periodically with notice that generally ranges from 45 to 90 days. There are no lockups or funding commitments. These limited partnership investments are classified as Level 3.

Registered investment companies: There are two methods of determining the unit value for the registered investment companies. For the registered investment company that is valued at an unaffiliated company the investment is valued using the closing price reported on the active market on which the funds are traded and is therefore classified as Level 1. For the registered investment company that is valued in-house on the unival system the NIF method is used which takes the unit value for the prior valuation day and multiplies it by the NIF for the current valuation day and is therefore classified as Level 2.

Other: Valued using the closing price reported on the active market on which the individual securities are traded. If Level 1 valuations are not available, the fair value is determined using models such as matrix pricing and therefore, is classified as Level 2, which uses quoted market prices with similar characteristics. Investments included in this category include short term investments, real estate investment trusts, asset backed securities, mortgage backed securities, swaps, derivatives, futures and options. Investments in multi-strategy hedge fund and real estate are based on the Plan's pro rata interest in the net assets of the partnership and have a redemption period and are reported in the Level 3 column. The multi-strategy hedge fund is comprised of two funds, one of which has a quarterly redemption period and the other with a monthly redemption period. They both require 45 day notice. The real estate fund does not have a specific redemption period, but is dependent upon the liquidation of underlying assets. None of the funds have a lock up period or funding commitment.

Cash: Stated at cost, which is equal to fair value, and held by an unaffiliated bank.

General Investment Account option: Liquidation value based on an actuarial formula as defined under the terms of the contract.

The following presents the fair value hierarchy of the Company's pension plan assets by asset class:

	December 31, 2019				
	Level 1	Level 2	Level 3	NAV Practical Expedient	Total
	(In Millions)				
Investments in the qualified pension plan:					
Pooled separate accounts:					
Common stocks:					
U.S. large capitalization	$ 176	-	-	-	176
International large capitalization	-	98	-	-	98
Total pooled separate accounts	176	98	-	-	274
Nonpooled separate accounts:					
Common stocks:					
U.S. large capitalization	316	-	-	-	316
U.S. small capitalization	18	-	-	-	18
U.S. mid-capitalization	7	-	-	-	7
International large capitalization	-	232	-	-	232
Total common stocks	341	232	-	-	573
Debt instruments:					
Corporate and other bonds	-	483	-	-	483
Long-term bond mutual fund	125	-	-	-	125
Short-term bond mutual funds	14	-	-	-	14
Total debt instruments	139	483	-	-	622
Registered investment companies:					
Emerging markets	-	38	-	-	38
Total registered investment companies	-	38	-	-	38
Other:					
Government securities	-	389	-	-	389
Collective investment trust	-	-	-	77	-
Other	-	61	-	-	61
Total other	-	450	-	77	527
Total separate investment accounts	656	1,301	-	77	2,034
Pension trust assets:					
Common stocks:					
Cash Equivalent	98	-	-	-	98
Collective investment trust	-	48	-	-	48
Hedge fund	-	-		24	24
Limited partnerships:					
Private equity/venture capital				142	142
Real estate				122	122
Hedge				93	93
Total pension trust assets	98	48	-	381	527
Total General Investment Account	-	-	245	-	245
Total	$ 754	$ 1,349	$ 245	$ 458	$ 2,806

	December 31, 2018				
	Level 1	Level 2	Level 3	NAV Practical Expedient	Total
	(In Millions)				
Investments in the qualified pension plan:					
Separate investment accounts:					
Common stocks:					
U.S. large capitalization	$ 66	$ 222	$ -	$ -	$ 288
U.S. small capitalization	19	41	-	-	60
U.S. mid capitalization	21	-	-	-	21
International small/mid capitalization	4	-	-	-	4
International large capitalization value	3	119	-	-	122
Total common stocks	113	382	-	-	495
Debt instruments:					
Corporate and other bonds	-	387	-	-	387
Long-term bond mutual fund	134	-	-	-	134
Short-term bond mutual funds	15	-	-	-	15
Total debt instruments	149	387	-	-	536
Registered investment companies:					
Emerging markets	-	59	-	-	59
U.S. large capitalization	16	-	-	-	16
Total registered investment companies	16	59	-	-	75
Limited partnerships:					
Private equity/venture capital	-	-	-	36	36
Total limited partnerships	-	-	-	36	36
Other:					
Government securities	-	353	-	-	353
Collective investment trust	-	160	-	-	160
Real estate	-	-	-	33	33
Emerging markets	-	46	-	-	46
Other	-	18	-	-	18
Total other	-	577	-	33	610
Total separate investment accounts	278	1,405	-	69	1,752
Pension trust assets:					
Common stocks:					
U.S. large capitalization	83	-	-	-	83
Collective investment trust	-	47	-	-	47
Hedge Fund	-	-	-	39	39
Limited partnerships:					
Other	-	-	-	233	233
Other	-	2	-	-	2
Total pension trust assets	83	49	-	272	404
Total general investment account	-	-	247	-	247
Total	$ 361	$ 1,454	$ 247	$ 341	$ 2,403

The Company evaluated the significance of transfers between levels based upon the nature of the financial instrument and size of the transfer relative to total net assets available for benefits. Based on these criteria, there were no significant transfers into or out of Level 1, 2, or 3 for the years ended December 31, 2019 and 2018.

f. *Amounts recognized in the Consolidated Statutory Statements of Financial Position*

Unrecognized prior service cost is the adjustment to the projected benefit obligation as a result of plan amendments. It represents the increase or decrease in benefits for service performed in prior periods. For pension benefits, this cost is amortized into net periodic benefit cost over the average remaining service years of active employees at the time of the amendment. For other postretirement benefits, this cost is amortized into net periodic benefit cost over the average remaining lifetime of eligible employees and retirees at the time of the amendment.

Unrecognized net actuarial (gains) losses are variances between assumptions used and actual experience. These assumptions include return on assets, discount rate, demographics and mortality. The unrecognized net actuarial (gains) losses are amortized if they exceed 10% of the projected benefit obligation and are amortized starting in the period after recognition. These are amortized for pension and other postretirement benefits into net periodic benefit cost over the remaining service-years of active employees.

The prepaid pension asset is a cumulative balance of employer contributions made to the plan netted against the plan's accumulated net periodic benefit costs. The prepaid pension asset is a nonadmitted asset.

The accrued benefit cost recognized is the funded status of the plan adjusted for the remaining balance of unrecognized prior service cost, unrecognized net actuarial loss and the nonadmitted prepaid pension asset.

The following sets forth the projected benefit obligation funded status of the plans:

	December 31,			
	2019	2018	2019	2018
	Pension Benefits		Other Postretirement Benefits	
	(In Millions)			
Projected benefit obligation	$ 3,270	$ 2,850	$ 383	$ 341
Less: fair value of plan assets	2,738	2,403	3	4
Projected benefit obligation funded status	$ (532)	$ (447)	$ (380)	$ (337)

The qualified pension plan was underfunded by $140 million as of December 31, 2019 and underfunded by $71 million as of December 31, 2018. The nonqualified pension plans are not funded and have total projected benefit obligations of $392 million as of December 31, 2019 and $377 million as of December 31, 2018.

The qualified pension plan nonadmitted pension plan asset was $642 million as of December 31, 2019 and $727 million as of December 31, 2018.

The Company intends to fund $119 million in 2020 to meet its expected current obligations under its qualified and nonqualified pension plans and other postretirement benefit plans.

g. Net periodic cost

The net periodic cost represents the annual accounting income or expense recognized by the Company and is included in general insurance expenses in the Consolidated Statutory Statements of Operations. The net periodic cost recognized is as follows:

	Years Ended December 31,			
	2019	2018	2019	2018
	Pension Benefits		Other Postretirement Benefits	
	(In Millions)			
Service cost	$ 111	$ 113	$ 13	$ 14
Interest cost	118	107	13	12
Expected return on plan assets	(160)	(171)	-	-
Amortization of unrecognized net actuarial and other losses	56	55	(1)	2
Amortization of unrecognized prior service cost	-	3	(6)	(6)
Total net periodic cost	$ 125	$ 107	$ 19	$ 22

The expected future pension and other postretirement benefit payments, which reflect expected future service, are as follows:

	Pension Benefits	Other Postretirement Benefits
	(In Millions)	
2020	$ 144	$ 17
2021	154	18
2022	157	18
2023	167	19
2024	179	19
2025-2029	1,023	100

The net expense recognized in the Consolidated Statutory Statements of Operations for all employee and agent benefit plans is as follows:

	Years Ended December 31, 2019	2018
	(In Millions)	
Health	$ 139	$ 113
Pension	125	107
Thrift	54	51
Postretirement	19	22
Disability	3	4
Life	4	4
Postemployment	8	(2)
Other benefits	13	23
Total	$ 365	$ 322

h. Assumptions

The assumptions the Company used to calculate the benefit obligations and to determine the benefit costs are as follows:

	December 31, 2019	2018	2019	2018
	Pension Benefits		Other Postretirement Benefits	
Weighted-average assumptions used to determine:				
Benefit obligations:				
Discount rate	3.05 %	4.20 %	3.05 %	4.05 %
Expected rate of compensation increase	3.50 %	3.50 %	3.50 %	3.50 %
Interest Crediting rate	5.00 %	6.00 %	3.05 %	4.05 %
Net periodic benefit cost:				
Discount rate	4.20 %	3.60 %	4.05 %	3.40 %
Expected long-term rate of return on plan assets	6.75 %	6.75 %	3.00 %	3.00 %
Expected rate of compensation increase	3.50 %	3.50 %	3.50 %	3.50 %
Interest Crediting rate	6.00 %	6.00 %	4.05 %	3.40 %

The discount rate used to determine the benefit obligations as of yearend is used to determine the expense in the next fiscal year.

The Company determines its assumptions for the expected rate of return on plan assets for its plans using a “building block” approach, which focuses on ranges of anticipated rates of return for each asset class. A weighted range of nominal rates is determined based on target allocations for each class of asset.

13. Employee compensation plans

The Company has a long-term incentive compensation plan under which certain employees of the Company and its subsidiaries may be issued phantom stock-based compensation awards. These awards include PSARs and PRS. These awards do not grant an equity or ownership interest in the Company.

A summary of the weighted average grant price of PSARs and PRS shares granted, the intrinsic value of PSARs shares exercised, the PRS liabilities paid and the fair value of shares vested during the year is as follows:

	December 31, 2019	December 31, 2018
Weighted average grant date fair value:		
PSARs granted during the year	$ 123.43	$ 98.77
PRS granted during the year	123.29	99.75
Intrinsic value (in thousands):		
PSARs options exercised	35,065	33,532
PRS liabilities paid	34,391	21,922
Fair value of shares vested during the year	69,456	42,141

A summary of PSARs and PRS shares is as follows:

	PSARs			PRS		
		Weighted Average			Weighted Average	
	Number of Share Units (In Thousands)	Price	Remaining Contract Terms (In Years)	Number of Share Units (In Thousands)	Price	Remaining Contract Terms (In Years)
Outstanding as of December 31, 2017	3,625	$ 85.78	3.1	1,204	$ 85.46	3.0
Granted	1,898	98.77		337	99.75	
Exercised	(992)	87.73		(217)	85.12	
Forfeited	(133)	90.59		(12)	87.60	
Outstanding as of December 31, 2018	4,398	90.81	3.7	1,312	87.84	2.8
Granted	1,677	123.43		297	123.29	
Exercised	(1,074)	89.40		(279)	86.23	
Forfeited	(195)	102.09		(60)	96.92	
Outstanding as of December 31, 2019	4,806	102.04	3.9	1,270	96.33	2.6
Exercisable as of December 31, 2019	191	$ 88.81	1.0	-	$ -	-

The PSARs compensation was an expense of $56 million for the year ended December 31, 2019 and an expense of $103 million for the year ended December 31, 2018. The PSARs accrued compensation liability was $108 million as of December 31, 2019 and $89 million as of December 31, 2018. The unrecognized compensation expense related to nonvested PSARs awards was $35 million as of December 31, 2019 and $54 million as of December 31, 2018. The weighted average period over which the expense is expected to be recognized is 3.9 years. The PSARs unrecognized compensation expense represents the total intrinsic value of all shares issued if 100% vested at current stock price, minus current compensation liability.

The PRS compensation expense was $46 million for the year ended December 31, 2019 and $53 million for the year ended December 31, 2018. The PRS accrued compensation liability was $97 million for the year ended December 31, 2019 and $87 million for year ended December 31, 2018. The unrecognized compensation expense related to nonvested PRS awards was $67 million as of December 31, 2019 and $69 million as of December 31, 2018. The weighted average period over which the expense is expected to be recognized is 2.6 years. The PRS unrecognized compensation expense represents the total value of all shares issued if 100% vested at the current stock price, minus current compensation liability.

14. Surplus notes

On October 11, 2019, MassMutual exchanged $57 million of its 5.625% surplus notes due 2033, $180 million of its 8.875% surplus notes due 2039, $137 million of its 5.375% surplus notes due 2041, $242 million of its 4.5% surplus notes due 2065 and $39 million cash for $838 million of 3.729% surplus notes due 2070. Interest on the 2070 surplus notes is payable semi-annually at a fixed rate.

The following table summarizes the surplus notes issued and outstanding as of December 31, 2019:

Issue Date	Face Amount	Carrying Value	Interest Rate	Maturity Date	Scheduled Interest Payment Dates
	($ In Millions)				
11/15/1993	$ 250	$ 250	7.625%	11/15/2023	May 15 & Nov 15
03/01/1994	100	100	7.500%	03/01/2024	Mar 1 & Sept 1
05/12/2003	193	193	5.625%	05/15/2033	May 15 & Nov 15
06/01/2009	130	128	8.875%	06/01/2039	Jun 1 & Dec 1
01/17/2012	263	263	5.375%	12/01/2041	Jun 1 & Dec 1
04/15/2015	258	254	4.500%	04/15/2065	Apr 15 & Oct 15
03/20/2017	475	471	4.900%	04/01/2077	Apr 1 & Oct 1
10/11/2019	838	576	3.729%	10/15/2070	Apr 15 & Oct 15
Total	$ 2,507	$ 2,235			

All payments of interest and principal are subject to the prior approval of the Division. Interest expense is not recorded until approval for payment is received from the Division. As of December 31, 2019, the unapproved interest was $24 million. Through December 31, 2019, MassMutual paid cumulative interest of $1,839 million on surplus notes. Interest of $132 million was approved and paid during the year ended December 31, 2019.

Anticipated sinking fund payments are due for the notes issued in 1993 and 1994 as follows: $62 million in 2021, $88 million in 2022, $150 million in 2023 and $50 million in 2024. There are no sinking fund requirements for the notes issued in 2003, 2009, 2012, 2015, 2017 or 2019.

These notes are unsecured and subordinate to all present and future indebtedness of MassMutual, all policy claims and all prior claims against MassMutual as provided by the Massachusetts General Laws. The surplus notes are all held by bank custodians for unaffiliated investors. All issuances were approved by the Division. Surplus notes are included in surplus on the Statutory Statements of Financial Position.

15. Presentation of the Consolidated Statutory Statements of Cash Flows

The following table presents those transactions that have affected the Company's recognized assets or liabilities but have not resulted in cash receipts or payments during the years ended December 31, 2019 and 2018. Accordingly, the Company has excluded these non-cash activities from the Consolidated Statutory Statements of Cash Flows for the years ended December 31, 2019 and 2018.

	Years Ended December 31, 2019	Years Ended December 31, 2018
	(In Millions)	
Bonds received as consideration for group annuity contracts	$ (916)	$ (292)
Bond conversions and refinancing	1,088	1,084
Premium income recognized for group annuity contracts	916	292
Change in market value of COLI	175	11
Transfer of bonds to partnerships and LLCs	135	281
Transfer of mortgage loans to partnerships and LLCs	96	244
Stock conversion	69	129
Net investment income payment-in-kind bonds	5	10
Dividend reinvestment	3	12
Other	1	123
Transfer of common stocks - affiliated to partnerships and LLCs	-	1,334
Partnerships and LLCs contributed to Insurance Road	-	476
Bonds and common stock contributed to EM Opportunities LLC	-	74

16. Business risks, commitments and contingencies

a. Risks and uncertainties

The Company operates in a business environment subject to various risks and uncertainties. The principal risks include insurance and underwriting risks, investment and interest rate risks, currency exchange risk and credit risk. The combined impact of these risks could have a material, adverse effect on the Company’s financial statements or result in operating losses in future periods. The Company employs the use of reinsurance, portfolio diversification, asset/liability management processes and other risk management techniques to mitigate the impact of these risks.

Insurance and underwriting risks

The Company prices its products based on estimated benefit payments reflecting assumptions with respect to mortality, morbidity, longevity, persistency, interest rates and other factors. If actual policy experience emerges that is significantly and adversely different from assumptions used in product pricing, the effect could be material to the profitability of the Company. For participating whole life products, the Company’s dividends to policyholders primarily reflect the difference between actual investment, mortality, expense and persistency experience and the experience embedded in the whole life premiums and guaranteed elements. The Company also reinsures certain life insurance and other long-term care insurance policies to mitigate the impact of its underwriting risk.

Investment and interest rate risks

The fair value, cash flows and earnings of investments can be influenced by a variety of factors including changes in interest rates, credit spreads, equity markets, portfolio asset allocation and general economic conditions. The Company employs a rigorous asset/liability management process to help mitigate the economic impacts of various investment risks, in particular interest rate risk. By effectively matching the market sensitivity of assets with the liabilities they support, the impact of interest rate changes is addressed, on an economic basis, as the change in the value of the asset is offset by a corresponding change in the value of the supported liability. The Company uses derivatives, such as interest rate swaps and swaptions, as well as synthetic assets to reduce interest rate and duration imbalances determined in asset/liability analyses.

The levels of U.S. interest rates are influenced by U.S. monetary policies and by the relative attractiveness of U.S. markets to investors versus other global markets. As interest rates increase, certain debt securities may experience amortization or prepayment speeds that are slower than those assumed at purchase, impacting the expected maturity of these securities and the ability to reinvest the proceeds at the higher yields. Rising interest rates may also result in a decrease in the fair value of the investment portfolio. As interest rates decline, certain debt securities may experience accelerated amortization and prepayment speeds than what was assumed at purchase. During such periods, the Company is at risk of lower net investment income as it may not be able to reinvest the proceeds at comparable yields. Declining interest rates may also increase the fair value of the investment portfolio.

Interest rates also have an impact on the Company's products with guaranteed minimum payouts and on interest credited to account holders. As interest rates decrease, investment spreads may contract as crediting rates approach minimum guarantees, resulting in an increased liability.

In periods of increasing interest rates, policy loans, surrenders and withdrawals may increase as policyholders seek investments with higher perceived returns. This could result in cash outflows requiring the Company to sell invested assets at a time when the prices of those assets are adversely affected by the increase in market interest rates, which could cause the Company to realize investment losses.

Currency exchange risk

The Company has currency risk due to its non-U.S. dollar denominated investments and medium-term notes along with its indirect international operations. The Company mitigates a portion of its currency risk through the use of cross-currency swaps and forward contracts. Cross-currency swaps are used to minimize currency risk for certain non-U.S. dollar assets and liabilities through a pre-specified exchange of interest and principal. Forward contracts are used to hedge movements in exchange rates.

Credit and other market risks

The Company manages its investments to limit credit and other market risks by diversifying its portfolio among various security types and industry sectors as well as purchasing credit default swaps to transfer some of the risk.

Stressed conditions, volatility and disruptions in global capital markets or in particular markets or financial asset classes can have an adverse effect on the Company, in part because the Company has a large investment portfolio and assets supporting the Company's insurance liabilities are sensitive to changing market factors. Global market factors, including interest rates, credit spread, equity prices, real estate markets, foreign currency exchange rates, consumer spending, business investment, government spending, the volatility and strength of the capital markets, deflation and inflation, all affect the business and economic environment and, ultimately, the profitability of the Company's business. Disruptions in one market or asset class can also spread to other markets or asset classes. Upheavals in the financial markets can also affect the Company's business through their effects on general levels of economic activity, employment and customer behavior.

Real estate markets are monitored continuously with attention on regional differences in price performance, absorption trends and supply and demand fundamentals that can impact the rate of foreclosures and delinquencies. Public sector strengths and weaknesses, job growth and macro-economic issues are factors that are closely monitored to identify any impact on the Company's real estate related investments.

The CMBS, RMBS and leveraged loan sectors are sensitive to evolving conditions that can impair the cash flows realized by investors and is subject to uncertainty. Management's judgment regarding OTTI and estimated fair value depends upon the evolving investment sector and economic conditions. It can also be affected by the market liquidity, a lack of which can make it difficult to obtain accurate market prices for RMBS and other investments, including CMBS and leveraged loans. Any deterioration in economic fundamentals, especially related to the housing sector could affect management's judgment regarding OTTI.

The Company has investments in structured products exposed primarily to the credit risk of corporate bank loans, corporate bonds or credit default swap contracts referencing corporate credit risk. Most of these structured investments are backed by corporate loans and are commonly known as collateralized loan obligations that are classified as CDO. The portfolios backing these investments are actively managed and diversified by industry and individual issuer concentrations. Due to the complex nature of CDO and the reduced level of transparency to the underlying collateral pools for many market participants, the recovery in CDO valuations generally lags the overall recovery in the underlying assets. Management believes its scenario analysis approach, based primarily on actual collateral data and forward looking assumptions, does capture the credit and most other risks in each pool. However, in a rapidly changing economic environment, the credit and other risks in each collateral pool will be more volatile and actual credit performance of CDO may differ from the Company's assumptions.

The Company continuously monitors its investments and assesses their liquidity and financial viability; however, the existence of the factors described above, as well as other market factors, could negatively impact the market value of the Company's investments. If the Company sells its investments prior to maturity or market recovery, these investments may yield a return that is less than the Company otherwise would have been able to realize.

Asset-based fees calculated as a percentage of the separate account assets are a source of revenue to the Company. Gains and losses in the investment markets may result in corresponding increases and decreases in the Company's separate account assets and related revenue.

Market risk arises within the Company's employee benefit plans to the extent that the obligations of the plans are not fully matched by assets with determinable cash flows. Pension and postretirement obligations are subject to change due to fluctuations in the discount rates used to measure the liabilities as well as factors such as changes in inflation, salary increases and participants living longer. The risks are that such fluctuations could result in assets that are insufficient over time to cover the level of projected benefit obligations. In addition, increases in inflation and members living longer could increase the pension and postretirement obligations. Management determines the level of this risk using reports prepared by independent actuaries and takes action, where appropriate, in terms of setting investment strategy and determining contribution levels. In the event that the pension obligations arising under the Company's employee benefit plans exceed the assets set aside to meet the obligations, the Company may be required to make additional contributions or increase its level of contributions to these plans.

b. Leases

The Company leases office space and equipment in the normal course of business under various noncancelable operating lease agreements. Additionally, the Company, as lessee, has entered various sublease agreements with affiliates for office space, such as Barings. Total rental expense on net operating leases, recorded in general insurance expenses, was $118 million for the year ended December 31, 2019 and $164 million for the year ended December 31, 2018. Net operating leases are net of sublease receipts of $10 million for the year ended December 31, 2019 and $11 million for the year ended December 31, 2018.

The Company has entered into two sale-leaseback transactions with unrelated parties to sell and leaseback certain fixed assets with book values of $110 million and $100 million, which resulted in no gain or loss. The leases have five year terms, which expire in 2020 and 2021 with annual lease payments of approximately $22 million and $20 million. At the end of the leases, the Company has the option to purchase the underlying assets at fair value.

Future minimum commitments for all lease obligations as of December 31, 2019 were as follows:

	Gross	Affiliated Subleases	Nonaffiliated Subleases	Net
	(In Millions)			
2020	$ 118	$ 5	$ 2	$ 111
2021	93	4	1	88
2022	62	1	1	60
2023	52	1	-	51
2024	37	-	-	37
Thereafter	59	-	-	59
Total	$ 421	$ 11	$ 4	$ 406

c. Guaranty funds

The Company is subject to state insurance guaranty fund laws. These laws assess insurance companies' amounts to be used to pay benefits to policyholders and policy claimants of insolvent insurance companies. Many states allow these assessments to be credited against future premium taxes. The Company believes such assessments in excess of amounts accrued will not materially impact its financial position, results of operations or liquidity.

d. Litigation and regulatory matters

In the normal course of business, the Company is involved in disputes, litigation and governmental or regulatory inquiries, administrative proceedings, examinations and investigations, both pending and threatened. These matters, if resolved adversely against the Company or settled, may result in monetary damages, fines and penalties or require changes in the Company's business practices. The resolution or settlement of these matters is inherently difficult to predict. Based upon the Company's assessment of these pending matters, the Company does not believe that the amount of any judgment, settlement or other action arising from any pending matter is likely to have a material adverse effect on the consolidated statement of financial position. However, an adverse outcome in certain matters could have a material adverse effect on the consolidated results of operations for the period in which such matter is resolved, or an accrual is determined to be required, on the consolidated financial statement financial position, or on our reputation.

The Company evaluates the need for accruals of loss contingencies for each matter. When a liability for a matter is probable and can be estimated, the Company accrues an estimate of the loss and any related insurance recoveries, if any. An accrual is subject to subsequent adjustment as a result of additional information and other developments. The resolution of matters are inherently difficult to predict, especially in the early stages of matter. Even if a loss is probable, due to many complex factors, such as speed of discovery and the timing of court decisions or rulings, a loss or range of loss may not be reasonably estimated until the later stages of the matter. For matters where a loss is material and it is either probable or reasonably possible then it is disclosed. For matters where a loss may be reasonably possible, but not probable, or is probable but not reasonably estimated, no accrual is established, but the matter, if material, is disclosed.

e. Commitments

In the normal course of business, the Company provides specified guarantees and funding to MMHLLC and certain of its subsidiaries. As of December 31, 2019, the Company had approximately $622 million of these unsecured funding commitments to its subsidiaries and $387 million as of December 31, 2018. The unsecured commitments are included in private placements in the table below. As of December 31, 2019 and 2018, the Company had not funded, nor had an outstanding balance due on, these commitments.

In the normal course of business, the Company enters into letter of credit arrangements. The Company had outstanding letter of credit arrangements of approximately $145 million as of December 31, 2019 and approximately $192 million as of December 31, 2018. As of December 31, 2019 and 2018, the Company did not have any funding requests attributable to these letter of credit arrangements.

In the normal course of business, the Company enters into commitments to purchase certain investments. The majority of these commitments have funding periods that extend between one and five years. The Company is not required to fund commitments once the commitment period expires.

As of December 31, 2019, the Company had the following outstanding commitments:

	2020	2021	2022	2023	2024	Thereafter	Total
	(In Millions)						
Private placements	$ 2,791	$ 341	$ 139	$ 673	$ 2	$ 1,925	$ 5,871
Mortgage loans	780	596	388	24	133	130	2,051
Real estate	1	-	-	-	-	-	1
Partnerships and LLCs	319	173	1,000	391	151	531	2,565
LIHTCs (including equity contributions)	107	158	119	1	-	6	391
Total	$ 3,998	$ 1,268	$ 1,646	$ 1,089	$ 286	$ 2,592	$ 10,879

In the normal course of business the Company enters into commitments related to property lease arrangements, certain indemnities, investments and other business obligations. As of December 31, 2019 and 2018, the Company had no outstanding obligations attributable to these commitments.

f. Guarantees

In the normal course of business the Company enters into guarantees related to employee and retirement benefits, the maintenance of subsidiary regulatory capital, surplus levels and liquidity sufficient to meet certain obligations, and other property lease arrangements. If the Company were to recognize a liability, the financial statement impact would be to recognize either an expense or an investment in a subsidiary, controlled, or affiliated entity. The Company has no expectations for recoveries from third parties should these guarantees be triggered. As of December 31, 2019 and 2018, the Company had no outstanding obligations to any obligor attributable to these guarantees.

The following details contingent guarantees that are made on behalf of the Company's subsidiaries and affiliates as of December 31, 2019.

Type of guarantee	Nature of guarantee (including term) and events and circumstances that would require the guarantor to perform under guarantee	Carrying amount of liability	Maximum potential amount of future payments (undiscounted) required under the guarantee
Employee and Retirement Benefits	The Company guarantees the payment of certain employee and retirement benefits for its wholly-owned subsidiary Barings, if the subsidiary is unable to pay.	-	The liabilities for these plans of $246 million have been recorded on the subsidiaries' books and represent the Company's maximum obligation.
Capital and Surplus Support of Subsidiaries	Certain guarantees of the Company provide for the maintenance of a subsidiary's regulatory capital, surplus levels and liquidity sufficient to meet certain obligations. These unlimited guarantees are made on behalf of certain wholly-owned subsidiaries. (C.M. Life and MML Bay State Life).	-	These guarantees are not limited and cannot be estimated.
Other Property Lease Arrangements	The Company guarantees the payment of various lease obligations on behalf of its subsidiaries and affiliates.	-	The future maximum potential obligations are immaterial to the Company.
Real Estate Development Completion Guarantee	The Company issued a construction loan for a real estate development project. The land on which the property is to be built is subject to a ground lease. In conjunction with issuing this construction loan, the Company has also issued a completion guarantee to the land owner that pays only in the event the project is not completed. The project is expected to be completed by July 2020.	-	$350 million.
Secure Capital for Variable Annuity Separate Accounts	The Company guarantees the capital contributions required to be made by a variable annuity separate account contract holder in the event the contract holder fails to payoff a subscription line utilized to deploy capital for the separate account.	-	$35 million with the right to increase the line to $60 million.

17. *Related party transactions*

MassMutual has management and service contracts and cost-sharing arrangements with various subsidiaries and affiliates where MassMutual, for a fee, will furnish a subsidiary or affiliate, as required, operating facilities, human resources, computer software development and managerial services.

MassMutual has agreements with its subsidiaries and affiliates, including Insurance Road LLC (IRLLC), Copper Hill LLC (CHLLC), MML Investment Advisers LLC, The MassMutual Trust Company, FSB, MassMutual International LLC (MMI) and Baring International Investment Limited, where MassMutual receives revenue for certain recordkeeping and other services that MassMutual provides to customers who select, as investment options, mutual funds managed by these affiliates.

MassMutual has agreements with its subsidiaries, Barings, MML Investment Advisers LLC and MassMutual Intellectual Property LLC (MMIP), which provide investment advisory services and licensing agreements to MassMutual.

The following table summarizes the transactions between MassMutual and the related parties:

	Years Ended December 31, 2019	Years Ended December 31, 2018
	(In Millions)	
Fee income:		
Management and service contracts and cost-sharing arrangements	$ 282	$ 293
Investment advisory income	25	24
Recordkeeping and other services	22	26
Fee expense:		
Investment advisory services	277	270
Royalty and licensing fees	58	56

The Company reported amounts due from subsidiaries and affiliates of $81 million as of December 31, 2019 and $82 million as of December 31, 2018. The Company reported amounts due to subsidiaries and affiliates of $35 million as of December 31, 2019 and $38 million as of December 31, 2018. Terms generally require settlement of these amounts within 30 to 90 days.

The Company's wholly owned indirect subsidiary, Barings, invest a portion of their nonqualified compensation plan in GICs with the Company. For the year ended December 31, 2019, the Company credited interest on deposits of $3 million to the Barings contract. For the year ended December 31, 2018, the Company credited interest on deposits to the Barings contract of less than $1 million.

The Company held debt issued by MMHLLC that amounted to $1,948 million as of December 31, 2019 and $2,183 million as of December 31, 2018. The Company recorded interest income on MMHLLC debt of $80 million in 2019 and $78 million in 2018. Notes maturing as at December 2018 and March 2019 were refinanced at 4.3% annual interest for $380 million.

As of December 31, 2019, MassMutual and C.M. Life, together, approved financing of $4,475 million for MassMutual Asset Finance, LLC (MMAF) that can be used to finance ongoing asset purchases and refinance existing MassMutual provided lines of credit. As of December 31, 2019 and 2018, MassMutual approved financing of $4,229 million. During 2019, MMAF borrowed $1,959 million and repaid $2,068 million under the credit facility. During 2018, MMAF borrowed $1,198 million and repaid $896 million under the credit facility. Outstanding borrowings under the facility with MassMutual and C.M. Life were $3,567 million as of December 31, 2019 and $3,682 million as of December 31, 2018. Interest for these borrowings was $96 million for the year ended December 31, 2019 and $79 million for the year ended December 31, 2018. The interest of this facility adjusts monthly based on the 30-day LIBOR.

Together, MassMutual and C.M. Life, provide a credit facility to Jefferies Finance, LLC whereby Jefferies Finance, LLC (Jefferies) borrows cash through short-term approved financings to fund the purchase of loans for securitization. During 2019, Jefferies borrowed $450 million and repaid $399 million under the credit facility. During 2018, Jefferies borrowed $361 million and repaid $586 million under the credit facility. As of December 31, 2019, the outstanding borrowings under this facility were $51 million. All outstanding interest due under the facility, as of December 31, 2019 had been paid. The interest of this facility is calculated based on a full pass through of interest accrued on the underlying loans purchased.

In 2018, the Company contributed $476 million in private equity investments and $81 million in bonds to its subsidiary Insurance Road LLC. In 2019, IRLLC declared a distribution to the Company of $150 million. In 2018, IRLLC declared a distribution to the Company of $749 million.

For further information on common stocks – subsidiaries and affiliates, refer to *Note 5c. "Common stocks – subsidiaries and affiliates"*.

In the normal course of business, the Company provides specified guarantees and funding to MMHLLC and certain of its subsidiaries. Refer to *Note 16e. "Commitments"* for information on the Company's accounting policies regarding these related party commitments and *Note 16f. "Guarantees"* for information on the guarantees.

18. Subsequent events

Management of the Company has evaluated subsequent events through February 24, 2020, the date the financial statements were available to be issued to state regulators and subsequently on the Company's website. No events have occurred subsequent to the date of the financial statements, except for:

On January 14, 2020, MassMutual issued a $550 million funding agreement with a 2.35% fixed rate and a 7-year maturity.

On January 15, 2020, MassMutual issued a $540 million funding agreement with a 3-month LIBOR rate and a 2-year maturity.